Seventeenth Annual Report
# of the
Commissioners
# of the
State Reservation at Niagara

Oct. 1, 1899 - Sept. 30, 1900

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Prospect Point.
(Frontispiece)

SEVENTEENTH ANNUAL REPORT

OF THE

COMMISSIONERS

OF THE

State Reservation at Niagara.

FROM OCTOBER 1, 1899, TO SEPTEMBER 30, 1900.

TRANSMITTED TO THE LEGISLATURE MARCH 13, 1901.

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STATE OF NEW YORK

No. 58.

IN ASSEMBLY,

March 13, 1901.

SEVENTEENTH ANNUAL REPORT

OF THE

Commissioners of the State Reservation at Niagara.

To the Honorable the Speaker of the Assembly:

Sir: I herewith transmit for presentation to the Legislature Seventeenth Annual Report of the Commissioners of the State Reservation at Niagara, for the fiscal year ended September 30, 1900.

Respectfully yours,

ANDREW H. GREEN,

President.

1900

~~Niagara Falls Historical Society, Inc.~~

SEVENTEENTH ANNUAL REPORT

OF THE

COMMISSIONERS

OF THE

STATE RESERVATION AT NIAGARA.

FOR THE FISCAL YEAR FROM

OCTOBER 1, 1899, TO SEPTEMBER 30, 1900.

Commissioners.

ANDREW H. GREEN, President.

GEORGE RAINES,	CHARLES M. DOW,
THOMAS P. KINGSFORD,	ALEXANDER J. PORTER.

Treasurer and Secretary.

PETER A. PORTER, Jr.

Superintendent.

THOMAS V. WELCH.

REPORT

To the Honorable the Legislature of the State of New York:

The Commissioners of the State Reservation at Niagara, as required by law, submit their report for the fiscal year begun October, 1899, and ended September 30, 1900, this being their seventeenth annual report.

The work of the year has been mainly in continuance of the system of improvement and restoration which the Commissioners have had in view, and in accordance with a previously adopted plan.

The last Legislature, appreciating well the importance of providing for the great number of people who visit Niagara, made liberal appropriations for improvements intended for the accommodation and safety of the public.

The two new bridges connecting the mainland with Goat Island are well under way, but the progress of the work has been somewhat impeded by unforeseen engineering difficulties arising from the difficult natural conditions. The Shelter and Administration building will be completed by the first of April. The improvement work on Goat and Luna Islands has been completed and meets with general favor. The further work of restoration contemplated for the year was completed in due time.

Since the abolishing of the toll charges and exactions on the Reservation, the number of visitors has annually increased, and owing to the prospects of an unprecedented number of visitors at the Falls the coming summer, the Commissioners ask your honorable body for an addition of $20,000 to the ordinary maintenance allowance. It will be necessary to use this sum in affording the visitors comfort, safety and a reasonable amount of freedom from annoyance. The unusual number of visitors will add materially to the receipts on the Inclined Railway, and the Superintendent estimates that as much or more than the $20,000 additional appropriation asked will be repaid into the State Treasury through the added income from carrying passengers at the Inclined Railway.

By provision in the act incorporating the Niagara Falls Power Company, and the acts amendatory thereto, that company is required to furnish electricity for light, heat and power, also water to be used for any purpose, to the State free of charge. The Commissioners have not heretofore availed themselves of this agreement owing in part to the expense of conducting the electricity and water from the power house to the Reservation property. We ask your honorable body for an appropriation of $7,100 to be used in adequately equipping the Reservation with electric conduits, wire and lamps. We have now but 20 lights on the Reservation, and for this light we are paying $600 per annum. The Reservation should be provided with at least 200 lights. The hydraulic appliances for sprinkling are grossly inadequate, and we ask for an appropriation of $7,500 to properly equip the grounds with a system of mains for water supply.

We ask $5,000 for filling and grading at the terminals of the two bridges connecting the mainland with Goat Island; the bridges being raised above the former bridge level will necessitate this filling.

A portion of the upper part of Goat Island was cleared of woods over a century ago. The Commissioners have directed the planting of forest trees in that section, thus restoring Goat Island to its primitive and natural condition so far as possible. For this we ask an appropriation of $1,500.

The following is our estimate and detailed statement of the work necessary to be done, and of the expenses of maintaining the Reservation for the fiscal year ending September 30, 1901.

Statement of Needed Improvements.

For extraordinary expenditures for the year 1901, care and maintenance by reason of Pan-American Exposition	$20,000 00
For filling and grading and putting grounds in order adjacent to stone arch bridges in course of construction from mainland to Goat Island	5,000 00
For electrical installations and lighting grounds and buildings	7,100 00
For system of water pipes for grounds and buildings.	7,500 00
For completion of and furnishing Shelter building	3,000 00
For bridge to Horseshoe Falls and Terrapin Point	1,000 00
For grading and planting	1,500 00
For paying tax, local assessment Nos. 21 and 22	2,165 15
	$47,265 15

The sum of $20,000 for extraordinary expenditures for the year 1901 is needed for extra police for preserving order, extra labor for keeping the Reservation grounds and buildings clean and orderly, and for extra guards for safety during the Pan-American Exposition, when ten times the usual number of visitors are expected.

The sum of $5,000 for filling and grading adjacent to the stone arch bridges in course of construction is needed to put the grounds adjacent to the bridges in order again, and to restore the slopes and shrubbery after the bridgework shall have been completed. The cost of constructing the bridges and the expenditures for engineering inspection, and care for the structures, and the safety of the public during the progress of the work will exhaust the appropriation for the bridges.

The sum of $7,100 for electrical installation and lighting grounds and buildings (to supplant the present inadequate lighting by 20 arc lamps at $50 each per annum).

Under the law the Commissioners of the Reservation are entitled to receive electricity from the Niagara Falls Power Company for lighting and power within the Reservation gratis.

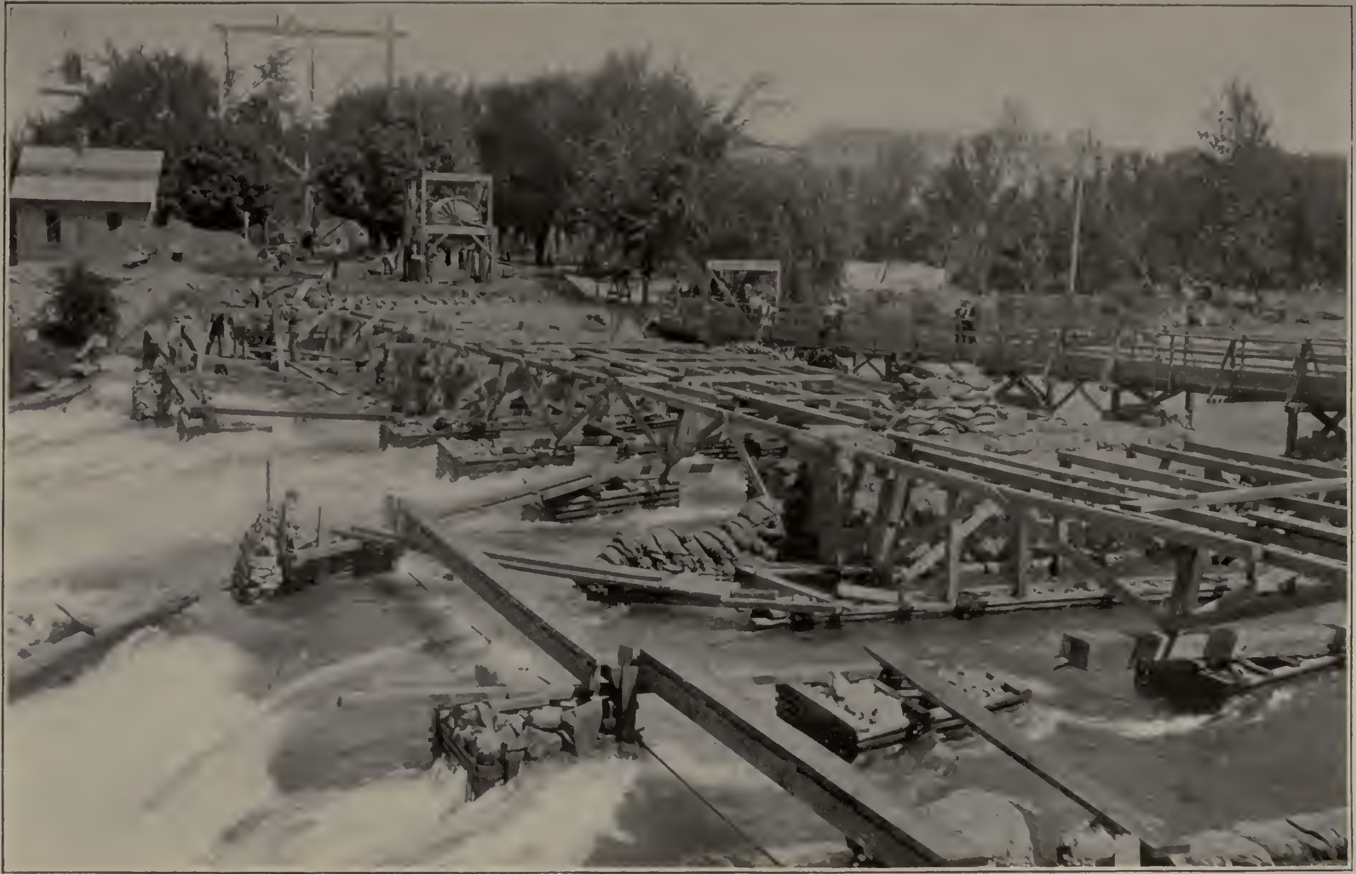
The Commissioners now propose to install an adequate system, and abolish the present cost of lighting.

The sum of $7,500 for system of water pipes for grounds and buildings is needed to supersede the inadequate system of surface water pipes now in use.

Under the law the Commissioners of the State Reservation at Niagara are entitled to receive water for the Reservation grounds and buildings gratis from the Niagara Falls Power Company. It is now proposed to install an adequate water system for the buildings, and for the lawns and roads, within the Reservation.

The sum of $3,000 for completion of and furnishing Shelter building is needed for changes and completing rooms not covered by contract, and for furnishing the Shelter building for public use.

The sum of $1,000 for bridge to Horseshoe Falls and Terrapin



Building Centers for Stone Arch Bridge. Green Island to Goat Island.

Point is needed to replace the present bridge at that point, which is old, dilapidated and inadequate. The State Engineer, upon inspection, recommends the renewal of this structure.

The sum of $1,500 for grading and planting is needed for planting the upper end of Goat Island (now almost entirely denuded of growth) with native trees and shrubs.

The sum of $2,165.15 is for local asssessments for paving Buffalo avenue, adjacent to the Reservation.

A statement of the local assessments has been forwarded to the Comptroller.

Ordinary Maintenance.

Salaries, office and traveling expenses	$4,600 00
Reservation police and caretakers	5,400 00
Labor	10,000 00
Material, tools, etc	5,000 00
	$25,000 00

Receipts.

In view of the large crowds which are expected to visit the Pan-American Exposition, and therefore the Reservation in 1901, any estimate of the receipts accruing to the State from the Reservation for the present fiscal year would be a matter of conjecture, but it would seem safe to assume that the income from the Inclined Railway will be very largely increased.

Estimated Receipts.

Inclined Railway	$20,000 00
Cave of the Winds	1,200 00
Steamboat landing	500 00
Carriage service	100 00
	$21,800 00

The Superintendent in his report has made a detailed statement of the work of the Commission for the last year, his report and that of the Treasurer and Secretary being appended to this report.

Respectfully submitted,
ANDREW H. GREEN,
President.
GEO. RAINES,
CHAS. M. DOW,
THOMAS P. KINGSFORD,
ALEXANDER J. PORTER,
Commissioners of the State Reservation at Niagara.

REPORT OF THE TREASURER AND SECRETARY

OF THE

State Reservation at Niagara

For the Fiscal Year Ending September 30, 1900.

Report of the Treasurer and Secretary.

To the Commissioners of the State Reservation at Niagara:

Gentlemen.—I respectfully submit the following report for the fiscal year begun October 1, 1899 and ended September 30, 1900.

As it embraces the last fiscal year of the century, and completes the fifteenth year of Free Niagara, it is the natural milestone in the progress of the advanced policy of the Empire State, in exercising its sovereign power for the acquisition of the lands at and adjacent to this world-famed spot, making them free to all mankind, and then proceeding to restore them, as far as possible, to their original, natural state; and a retrospect of the results thus far achieved may, therefore, be appropriately referred to.

The agitation for the sovereign ownership of Niagara which began in 1877 and ended July 15, 1885, on which date the State of New York entered into possession of the lands on the American side, was not an entirely new conception. Yet the idea, as then suggested, assumed such a tangible and business-like form, and appealed so strongly to all lovers of nature and of its unique and beautiful scenery, that it was at once encouraged by the influence of numerous prominent men, in many paths of life, not only in our own State but throughout the nation, and by reason of the world-wide love of Niagara, received the hearty endorsement of men, of great eminence, from across the ocean.

In 1834 Reverends Andrew Reed and Thomas Mattheson, as a deputation from the Presbyterian churches of Scotland, visited the Presbyterian churches of America, and in their journeys came to, and fully appreciated Niagara. In the history of their travels, in addition to expressing their admiration thereof, they left on record the following statement, which stands as the earliest public suggestion of an International Reservation at this place: "Niagara does not belong to Canada nor America. Such spots should be deemed the property of civilized mankind; and nothing should be allowed to weaken their efficacy on the tastes, the morals and the enjoyment of all men."

Fifty years later their suggestion became a reality; and what in 1834 was the far-sighted individual opinion of two eminent divines, became in 1885, by the action of the State of New York, supplemented in 1888 by the action of the Province of Ontario, an accomplished fact; sanctioned by the hearty endorsement of leading men everywhere and enacted by the votes of the elected representatives of the people, its fulfillment has been applauded and valued more and more each year by humanity in general.

For the permanent enjoyment of the annually increasing number of visitors to Niagara, occasioned by the increase in population and the constantly added facilities for travel, certain expenditures for additional improvements, whereby many beautiful points of view, now either unreached or reached only by such exertions as practically preclude access thereto by large numbers of people, on account of age or infirmity, may be made accessible, are urgently demanded.

During the decade and a half of Free Niagara's existence, all but two or three of the scores of unsightly structures that marred the harmony of the surroundings of the Niagara of old have been removed, and in their stead, restored banks, grassy slopes, graceful shrubbery and beautiful natural environments greet the eye. This gratifying result has been effected almost entirely on the main shore. For the Goat Island group, save for the mill on Bath, or as it is now called, Green Island (perhaps the most unsightly structure ever erected within the sound of the great cataract and of which every vestige has been happily swept away) needed no restoration. Goat Island and the adjacent islands were covered with an original bit of virgin forest, which, fortunately, has been conscientiously preserved in its primeval state, all undespoiled by man's so-called progress and improvements.

The experimental stage of Free Niagara, determining whether the State's action in reference thereto would be appreciated by the people, and the Falls visited by them in increased numbers, has long since been passed, and is answered by a hearty affirmative. In recording this gratifying verdict at the commencement of the Twentieth century the people strongly recommend a continuance and even an expansion of that liberal policy on the part of the State which has made the Reservation the beautiful spot it is to-day.

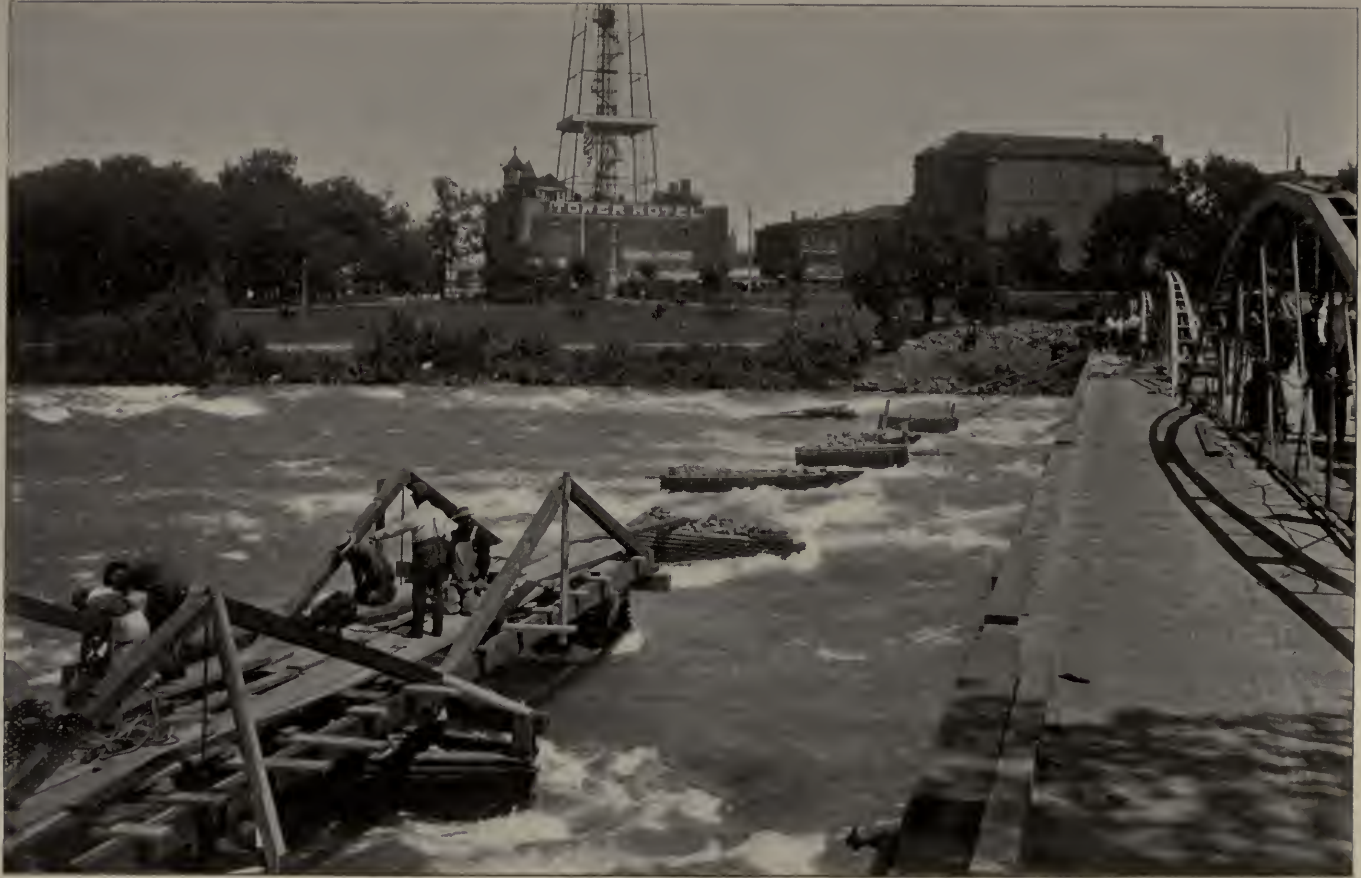
Of the certainly not less than five, and probably more, bridges which have in the past, and should in the future, afford access from Goat Island to the adjoining islands, two have already been reconstructed in enduring stone, and the remaining ones should be similarly rebuilt in the near future. One of these two stone bridges thus referred to, connects Goat Island with the first Sister Island. The last Legislature granted an appropriation of $3,000 for repairs to the existing bridges that connect the first with the second and the second with the third Sister Island.

Regarding another of these bridges, namely, the one from Goat

Island to the Terrapin Rocks, the recommendation is renewed for a substantial bridge at this point. Special stress may be laid on this appropriation, as the Terrapin Rocks are the geographical and scenic center of Niagara, a point which hardly any visitor to Goat Island, who is physically able to make the trip up and down the steps, fails to visit.

An elevator and new staircase by which easy access should be afforded to the debris slope below Goat Island has heretofore been recommended and is more urgently needed each year. Below the bank here is the Cave of the Winds which affords not only the most distinctly unique trip at Niagara, by means of which are to be obtained otherwise unobtainable views of little known and marvelous scenery, but the only place where one may pass completely around and behind the falling sheet of water. At the end of this debris slope next to the Horseshoe Falls, may be obtained new and almost unknown views, views which Professor Tyndall regarded as beyond compare the finest at the Falls, and at this point he penetrated farther than almost any visitor has ever done before around the curve of the Horseshoe, toward what he called the "Ultima Thule" of Niagara. The only access to this but comparatively little visited debris slope is by the winding stairway called the Biddle Stairs, in honor of Nicholas Biddle of United States Bank fame, who is credited with having suggested to the owners of Goat Island this means of accomplishing the descent, and is further said to have offered to share the expense of their construction, although this philanthropic part of his suggestion was declined.

Having been in use for nearly three-quarters of a century, they should be replaced by a more substantial, safe, and more modern means of descent.



Building Temporary Bridge.

The details of the work that has been accomplished on the Reservation during the fiscal year is fully and concisely set forth in the report of the Superintendent which accompanies this report. One piece of work, however, completed during the year demands special notice. The last Legislature appropriated $5,000 for extraordinary expenditures for the year 1900. The most of it was expended in replacing the wooden stairway at the American Falls on Goat Island with a handsome stone stairway protected by an indispensable iron guard rail. From Goat Island this stairway affords access to Luna Island, from which and from the stairway itself are to be obtained the most imposing views of the American Falls, of the Cave of the Winds Fall and of the gorge below.

The upper end of Goat Island, where is the open space cleared some hundred and twenty-five years ago, and on which it is recorded that John Stedman in early days raised a fine crop of turnips, has been ordered planted with appropriate and indigenous trees.

The liberal appropriation made by the last Legislature for the erection of a bridge between the mainland and Goat Island resulted in letting a contract for the erection of a steel concrete and stone bridge to replace the iron trussed bridge, which, during the last half century has afforded access to so many millions of visitors to Goat Island.

The engineering difficulties were numerous, but by reason of the vast improvements of modern science and the aid of the old bridge, were far less than those encountered when the first bridge was constructed on this site in 1818.

In spite of the dangers of the work of construction, thanks to the special care and precautions employed by the contractors, no accident has occurred during the building of the bridge that was attributable to the hazardous nature of the work, or its location in and over the rushing rapids of Niagara. While the progress of this bridgework has been much slower than expected, the work will be prosecuted with all possible speed and the bridge will be completed and available for use in the early part of the summer 1901, practically in time to accommodate the vast crowds which are expected at Niagara as a result of the Pan-American Exposition at Buffalo, in anticipation of which event the appropriation for this bridge was granted by the Legislature.

On the main shore in addition to the detail work fully set forth by the Superintendent in his report, two features deserve special notice. The granting of a revocable license to the International Traction Company (which controls largely the trolley lines on both sides of the river at Niagara, and also two bridges across the gorge) to lay a track on the Riverway between Falls street and the north end of the Reservation, has already been reported, and thus far the grant has worked to the advantage of the Reservation and the accommodation of visitors. With the completion of the company's projected terminal station, facing the Reservation, this grant will continue to result in decided advantages of access to the patrons of Free Niagara.

The inadequacy of the small building on Green Island used as an office for the Commissioners, and the insufficiency of the Superintendent's office located in the old Inclined Railway building, led to the recommendation for the erection of an Administration building, where should be located all the offices of the Commissioners and officials, and which would also furnish a much needed Shelter building for the accommodation of visitors, which building should be located in Prospect Park. The Legislative appropriation of 1898 for this purpose proved inadequate to erect the beautiful Gothic structure as originally designed by the State Architect. Subsequently, through his co-operation, certain changes were made reducing the height but not the ground floor area of the building and still preserving its classic beauties. The structure commenced last summer is now well advanced and is expected to be ready for occupation by April 1, 1901.

During the past year, in the interest of good order on the Reservation, it was decided to abolish all the hack stands theretofore allowed on the State property. This action was induced by reason of the many complaints that were made of petty annoyances and solicitations.

On February 1, 1900, Mr. Richard F. Rankine, who had so efficiently filled the office of secretary and treasurer to the Commissioners, resigned that office, and Mr. Peter A. Porter, Jr., was elected to fill the position. Thanks are due to Mr. Edward A. Bond, State Engineer, for his personal interest in the work of the Commission and his repeated attendance at the meetings and the suggestions and aid thus given. Also to Mr. G. L. Heins, State Architect, for his valuable co-operation and assistance in matters relating to his department.

It is again recommended that a topographical survey of the Falls be authorized and provided for. The value of the survey made ten years ago, and furnishing in connection with several prior surveyors a minute and accurate record, not only of the recession of the Falls themselves, but of the changes, erosive and creative, in the lines of the banks, renders this recurring ten-year period, and the commencement of the twentieth century a suitable time for this important work.

The present stone structure, built many years ago, which covers the upper end of the Inclined Railway is not only incommodious and unsightly, but is decidedly detrimental in that it obstructs what would otherwise be an uninterrupted view of the Falls from a very large portion of Prospect Park. With the facilities afforded by the new Shelter building, it will become merely the protection for the upper end of the Inclined Railway, and it is urged that an appropriation be granted for the purpose of demolishing this building and substituting in its place a suitable, permanent structure, located below the level of the land, whose roof shall be raised so little, if any, above the surface as to offer no obstruction to the view. At the same time such a building specially designed for the purpose, by its lower level would increase the water power, slightly lessen the length of the incline, and thus increase the facilities for handling the large crowds which frequently congregate at this point, all anxious to descend to the slope below.

In view of the Pan-American Exhibition to be held at Buffalo from May 1st to November 1st, 1901, and toward which the State has appropriated $300,000 for a suitable building and exhibit, and the reasonable and certain deduction, that of the several millions of people who are expected to visit it, a large majority will visit Niagara, and therefore the Reservation (for as an attraction Niagara Falls will be fully as great as the Exposition itself) a very much larger maintenance appropriation is desired, to the end that the comfort of and facilities for these extra visitors may be provided and their safety conserved, a most important consideration at a spot like Niagara, where amid such vast crushes of humanity at points of special scenic attraction, beauty and danger often go hand in hand. The needed increase in the force of caretakers and policemen will also tend to the preservation of the property of the Reservation, especially from the wanton destruction of small trees and shrubs, many of them recently planted by the order of the Commissioners, and will aid in and be required for the preservation of that good order which, especially among such throngs of visitors, it is the State's imperative duty to maintain for the benefit of all, and notably in behalf of the youthful, the aged and the infirm.

Respectfully submitted,

PETER A. PORTER, JR.,

Treasurer and Secretary.

THE COMMISSIONERS OF THE STATE RESERVATION AT NIAGARA in account with PETER A. PORTER, JR., Treasurer, for the fiscal year begun October 1, 1899, and ending September 30, 1900.

1899.				
Oct.	1.	Balance on hand this date..............		$27 51
		Maintenance Receipts.		
Nov.	3.	Quarterly advance from State Comptroller	$6,250 00	
1900.				
Jan.	21.	Quarterly advance from State Comptroller	6,250 00	
April	23.	Quarterly advance from State Comptroller	6,250 00	
July	18.	Quarterly advance from State Comptroller	6,250 00	
				25,000 00

Special appropriation as per Chapter 569, Laws of 1899:

1899.				
Oct.	16.	Payment by State Comptroller on account	$485 00	
Dec.	28.	Payment by State Comptroller on account	921 78	
1900.				
June	12.	Payment by State Comptroller on account	16 85	
July	25.	Payment by State Comptroller on account	6 75	
Sept.	20.	Payment by State Comptroller on account	21 75	
	27.	Payment by State Comptroller on account	10 00	
				$1,462 13

Special appropriation as per Chapter 420, Laws of 1900:

1900.				
Aug.	31.	Payment by State Comptroller on account	$453 11	
Sept.	20.	Payment by State Comptroller on account	596 14	
	27.	Payment by State Comptroller on account	413 46	
	30.	Payment by State Comptroller on account	7,803 00	
	30.	Payment by State Comptroller on account	9,554 00	
				18,819 71

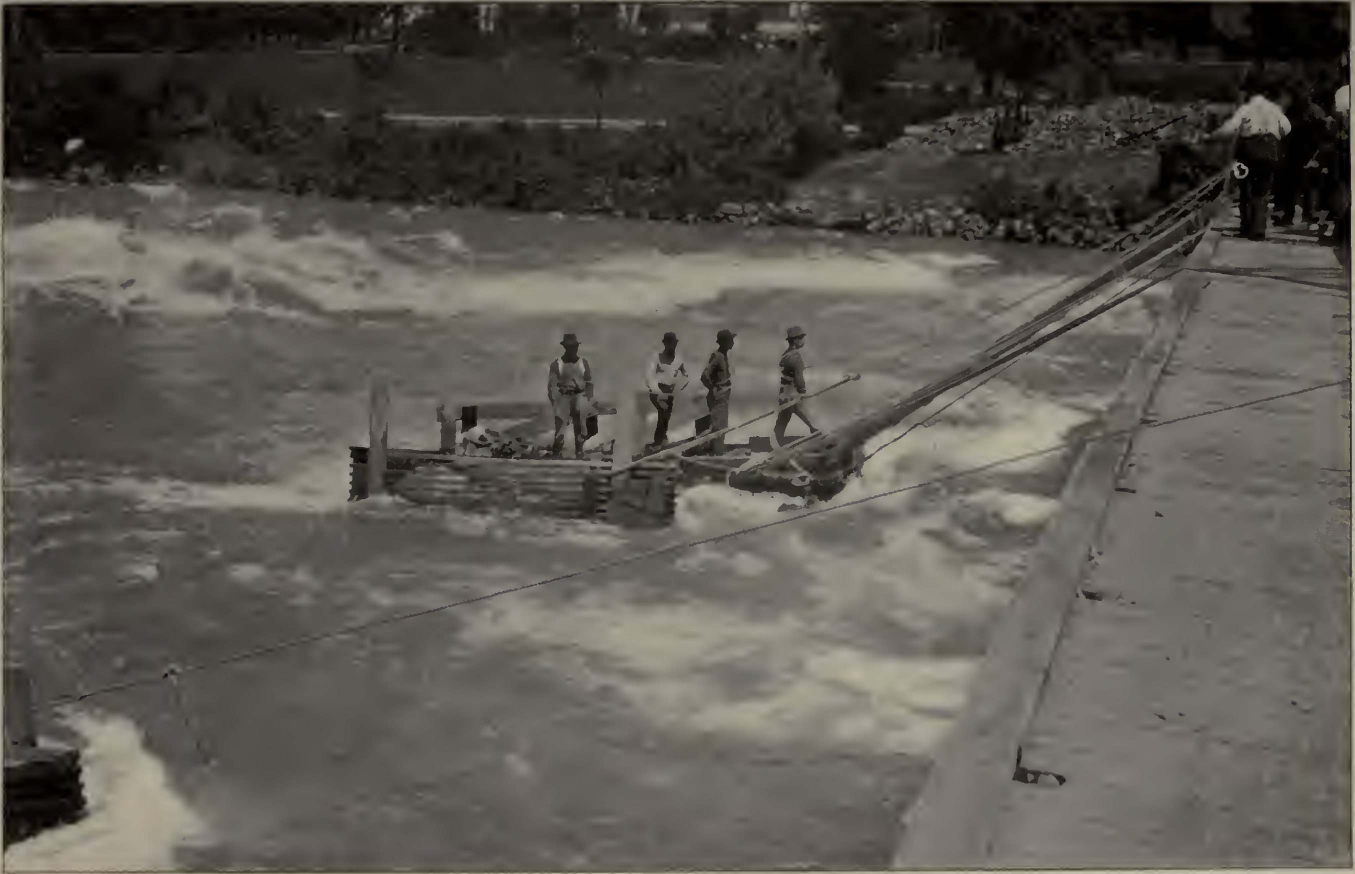
Special appropriation as per Chapter 419, Laws of 1900:

1900.				
July	13.	Payment by State Comptroller on account	$349 75	
	25.	Payment by State Comptroller on account	331 43	
Aug.	7.	Payment by State Comptroller on account	1,498 29	
Sept.	20.	Payment by State Comptroller on account	1,983 49	
	27.	Payment by State Comptroller on account	61 25	
				$4,224 21

Receipts of Reservation.

1899.			
Nov.	1.	Draft on Bank of Niagara for October receipts	$308 10
Dec.	1.	Draft on Bank of Niagara for November receipts	78 95
1900.			
Jan.	1.	Draft on Bank of Niagara for December receipts	35 55
Feb.	1.	Draft on Bank of Niagara for January receipts	70 20
March	1.	Draft on Bank of Niagara for February receipts	348 50
April	1.	Draft on Bank of Niagara for March receipts	251 70
May	1.	Draft on Bank of Niagara for April receipts	72 10

1900.				
June	1.	Draft on Bank of Niagara for May receipts	$230 80	
July	1.	Draft on Bank of Niagara for June receipts	645 30	
Aug.	1.	Draft on Bank of Niagara for July receipts	1,612 45	
Sept.	1.	Draft on Bank of Niagara for August receipts	2,809 70	
	30.	Draft on Bank of Niagara for September receipts	2,076 45	
				$8,539 80
1900.				
March	31.	Interest on balances in Manufacturers and Traders' Bank	$6 05	
June	30.	Interest on balances in Manufacturers and Traders' Bank	8 07	
				14 12
Total				$58,087 48



Building Piers for Temporary Bridge.

Expenditures.

Abstract CXVIII.

Date.	No. of Voucher.	Name.	Amount.
1899.			
Nov. 4.	1752.	R. F. Rankine, Secretary and Treasurer, office expenses	$7 28
	1753.	R. F. Rankine, Secretary and Treasurer, salary October, 1899	83 33
6.	1754.	Pay roll, October, 1899	1,579 33
7.	1755.	Thomas V. Welch, Commissioner's and office expenses	45 67
17.	1756.	Globe Ticket Co., Inclined Railway	10 50
	1757.	Hardwicke & Co., water pipes	2 52
	1758.	Walker & Paterson, tools, buildings, Inclined Railway	10 47
	1759.	Walker & Paterson, tools, buildings, Inclined Railway	15 55
	1760.	James Davy, stationery	11 00
	1761.	N. F. Hydraulic Power and Mfg. Co., electric lighting	50 00
	1762.	N. F. Hydraulic Power and Mfg. Co., electric lighting	50 00
	1763.	Andrew H. Green, Commissioner's expenses	41 70

Abstract CXIX.

Date.	No. of Voucher.	Name.	Amount.	
1899.				
Nov. 17.	1764.	J. H. Cook & Co., buildings.	$30 10	
	1765.	P. J. Davy, buildings	47 13	
	1766.	T. P. Kingsford, Commissioner's expenses	152 10	
Dec. 2.	1767.	Pay-roll, November, 1899	1,324 03	
	1768.	Thos. V. Welch, Superintendent's office expenses.	18 24	
	1769.	R. F. Rankine, Secretary and Treasurer, salary November, 1899	83 33	
				$3,562 28
Dec. 9.	1770.	P. C. Flynn & Son, buildings, iron railing	$70 12	
	1771.	Peterson & Grant, buildings	7 00	
	1772.	P. J. Davy, water pipes	53 05	
	1773.	Hardwicke & Co., water pipes	55 97	
	1774.	Gazette Publishing Co., Superintendent's office expenses	2 25	
	1775.	Walker & Paterson, tools, buildings	21 62	
	1776.	N. F. Hydraulic Power and Mfg. Co., electric lighting.	50 00	
14.	1777.	A. J. Porter, Commissioner's expenses	24 50	

Date.	No. of Voucher.	Name.	Amount.	
1899.				
Dec. 22.	1778	Alexander Henschel, President's office expenses	$70 00	
30.	1779	Pay-roll, December, 1899	1,392 55	
	1780	Thos. V. Welch, Superintendent's office expenses	49 05	
				$1,796 11

Abstract CXX.

1900.				
Jan. 8.	1781	R. F. Rankine, Secretary and Treasurer, traveling expenses	$28 37	
	1782	R. F. Rankine, Secretary and Treasurer, salary, December, 1899	83 33	
				111 70

Abstract CXXI.

Feb. 2.	1783	R. F. Rankine, Secretary and Treasurer, salary January, 1900	$83 33
	1784	R. F. Rankine, Secretary and Treasurer, office expenses	3 59
	1785	Pay-roll, January, 1900	1,198 29
	1786	Pay-roll, January, 1900, supplemental	475 25
3.	1787	Gazette Publishing Co., Superintendent's office expenses	2 25

Date.	No. of Voucher.	Name.	Amount.
1900.			
Feb. 3.	1788.	James Davy, Superintendent's office expenses.....	$6 85
	1789.	Thos. E. McGarigle, bridges.	30 55
	1790.	Alvah Bushnell Co., Superintendent's office expenses	6 00
	1791.	Welch Coal & Wood Co., coal	60 50
	1792.	J. H. Cook & Co., bridges, buildings	34 69
	1793.	J. H. Cook & Co. buildings.	44 79
	1794.	N. F. Hy. Power & Mfg. Co., electric lighting.....	50 00
	1795.	N. F. Hy. Power & Mfg. Co., electric lighting.....	50 00
	1796.	Walker & Paterson, buildings	13 68
	1797.	Walker & Paterson, tools, buildings	11 21
	1798.	Thos. V. Welch, Superintendent's office expenses..	41 50
8.	1799.	Charles M. Dow, Commissioner's expenses	398 14
13.	1800.	National Press Intelligence Co., Secretary and Treasurer, office expenses.....	1 10
17.	1801.	Peter A. Porter, Jr., Secretary and Treasurer, office expenses	26 38

Date.		No. of Voucher.	Name.	Amount.
1900.				
Feb.	17.	1802	A. J. Porter, Commissioner's expenses	$22 89
	21.	1803	Pay-roll, February, 1900, Prospect Park	191 50
	28.	1804	Peter A. Porter, Jr., Secretary and Treasurer, salary, February, 1900	83 33
March	1.	1805	Pay-roll, February, 1900	1,007 91
	2.	1806	Thos. V. Welch, Superintendent's office expenses	35 10
	5.	1807	Milton E. Johnson & Co., Secretary and Treasurer, office expenses	14 00
	7.	1808	Pay-roll February, 1900, supplemental	294 50
	29.	1809	A. J. Porter, Commissioner's expenses	19 43
April	2.	1810	Peter A. Porter, Jr., Secretary and Treasurer, salary, March, 1900	83 33
		1811	Thos. V. Welch, Superintendent's office expenses	47 51
		1812	Pay-roll, March, 1900	1,486 17
	6.	1813	Joseph McDonald, coal	11 95
		1814	Grout Electrical Co., Inclined Ry	7 60
		1815	Elizabeth Read, ice	44 16
		1816	N. F. Hydraulic Power and Mfg. Co., electric lighting	50 00

Date.	No. of Voucher.	Name.	Amount.	
1900.				
April 6.	1817.	Gazette Publishing Co., Superintendent's office expenses	$15 00	
	1818.	Gazette Publishing Co., Superintendent's office expenses	6 25	
	1819.	N. F. Hy. Power & Mfg. Co., electric lighting	50 00	
	1820.	Walker & Paterson, tools, buildings	18 72	
	1821.	Walker & Paterson, tools, buildings	9 05	
	1822.	W. A. Shepard, bridges, buildings	17 99	
	1823.	Arthur C. Kugel, roads	6 30	
				$6,060 79

Abstract CXXII.

Date.	No. of Voucher.	Name.	Amount.	
April 27.	1824.	A. J. Porter, Commissioner's expenses	$26 95	
30.	1825.	Peter A. Porter, Jr., Secretary and Treasurer, salary, April, 1900	83 33	
May 2.	1826.	Thos. V. Welch, Superintendent's, office expenses	49 90	
	1827.	Pay-roll, April, 1900	2,040 40	
				2,200 58

Abstract CXXIII.

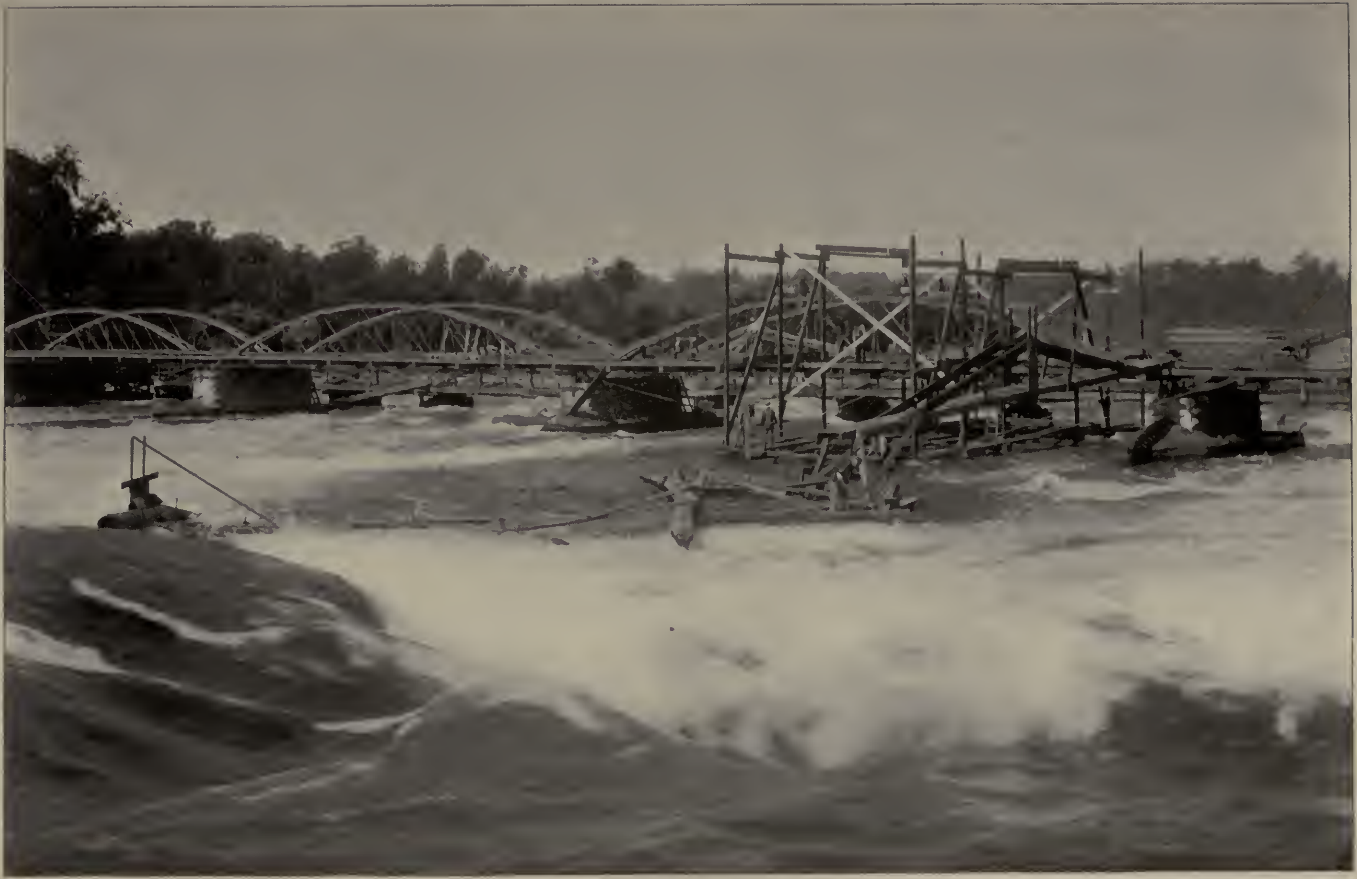
Date.		No. of Voucher.	Name.	Amount.	
1900.					
May	22.	1828	George Raines, Commissioner's expenses	$37 62	
	23.	1829	P. C. Flynn & Son, buildings	191 02	
		1830	F. W. Oliver Co., tools	75	
		1831	Brophy & Co., seed	3 50	
		1832	Welch Coal and Wood Co., coal	76 25	
		1833	J. H. Cook & Co., buildings.	8 39	
	23.	1834	William F. Wall. Inclined Railway	231 07	
		1835	Walker & Paterson, buildings, tools, Inclined Railway and water pipes	78 11	
		1836	F. W. Oliver & Co., tools	5 65	
		1837	N. F. Hydraulic Power and Mfg. Co., electric lighting.	50 00	
	31.	1838	Peter A. Porter, Jr., Secretary and Treasurer, salary May, 1900	83 33	
June	1.	1839	Pay-roll, May, 1900	2,202 50	
	4.	1840	Thos. V. Welch, Superintendent's office expenses.	32 58	
	5.	1841	Peter A. Porter, Jr., Secretary and Treasurer, office expenses	10 86	
					$3,011 63

Abstract CXXIV.

Date.		No. of Voucher.	Name.	Amount.	
1900.					
June	7.	1842.	Andrew H. Green, Commissioner's expenses	$31 65	
	13.	1843.	A. J. Porter, Commissioner's expenses	19 90	
	15.	1844.	Thos. V. Welch, Superintendent's office expenses	25 95	
	18.	1845.	Peter A. Porter, Jr., Secretary and Treasurer, traveling expenses	25 00	
	20.	1846.	Thos. V. Welch, Superintendent's office expenses	24 50	
		1847.	A. J. Porter, Commissioner's expenses	25 00	
	30.	1848.	Peter A. Porter, Jr., Secretary and Treasurer, salary, June, 1900	83 33	
July	3.	1849.	Pay-roll, June, 1900	1,772 62	
					$2,007 95

Abstract CXXV.

Date.		No. of Voucher.	Name.	Amount.
July	9.	1850.	National Press Intelligence Co., Secretary and Treasurer's office expenses	$5 00
	19.	1851.	Elderfield-Hartshorn Co., tools, buildings	54 28
		1852.	Niagara Electric Equipment Co., inclined railway	1 28
		1853.	P. J. Davy, buildings	23 10



Building Coffer Dam in Rapids.

Date.	No. of Voucher.	Name.	Amount.
1900.			
July 31.	1854.	Peter A. Porter, Jr., Secretary and Treasurer, salary, July, 1900	$83 33
Aug. 2.	1855.	West Disinfecting Co., buildings	48 00
	1856.	N. F. Hy. Power and Mfg. Co., electric lighting	50 00
	1857.	N. F. Hy. Power and Mfg. Co., electric lighting	50 00
	1858.	F. W. Oliver Co. tools	2 70
	1859.	Niagara Electric Equipment Co., inclined railway	2 89
	1860.	Elderfield–Hartshorn Co., water pipes tools, buildings	30 22
	1861.	J. H. Cook & Co., buildings	8 90
	1862.	Charlotte Haeberle, inclined railway	11 00
	1863.	Thos. McKnight, roads	100 00
	1864.	Thos. V. Welch, Superintendent's office expenses	42 27
	1865.	Pay-roll, July, 1900	1,888 61
21.	1866.	Pay-roll, August, 1900	339 00
	1867.	Thos. V. Welch, Superintendent's office expenses	49 46
31.	1868.	Peter A. Porter, Jr., Secretary and Treasurer, salary, August, 1900	83 33

Date.	No. of Voucher.	Name.	Amount.
1900.			
Sept. 4.	1869	Pay-roll, August, 1900	$1,200 87
	1870	Peter A. Porter, Jr., Secretary and Treasurer, office expenses	41 68
	1871	Elderfield–Hartshorn Co., tools	24 84
	1872	Elderfield–Hartshorn Co., water pipes, tools, buildings	72 39
	1873	James B. Lyon, extra annual reports	45 00
	1874	W. A. Shepard, bridges	71 03
	1875	Gazette Publishing Co., Superintendent's expenses	7 25
	1876	N. F. Hydraulic Power and Mfg. Co., electric lighting.	50 00
	1877	N. F. Hydraulic Power and Mfg. Co., electric lighting.	50 00
	1878	Globe Ticket Co., inclined railway	51 50
	1879	P. C. Flynn & Son, buildings	285 21
14.	1880	Pay-roll, September, 1900	45 00
30.	1881	Peter A. Porter, Secretary and Treasurer, September, 1900	83 37
	1882	Niagara Electric Equipment Co., inclined railway	1 50

Date.	No. of Voucher.	Name.	Amount.	
1900.				
Sept. 30.	1883	Cataract Ice Co., ice	$87 60	
	1884	P. C. Flynn & Son, signs	24 75	
	1885	Elderfield-Hartshorn Co., tools, water pipes, buildings	33 00	
	1886	N. F. Hydraulic Power and Mfg. Co., electric lighting	50 00	
	1887	Dean & Hoffman, roads, stairways	38 45	
	1888	Whitmore & Beaser, inclined railway	17 50	
	1889	Globe Ticket Co., inclined railway	6 50	
	1890	Thos. V. Welch, Superintendent's office expenses	49 49	
	1891	Peter A. Porter, Jr., Secretary and Treasurer, office expenses	15 98	
	1892	Fred Batchelor, seed	9 00	
	1893	Pay-roll, September, 1900	1,003 37	
				$6,238 65

Payments out of $30,000, *as per chapter* 569, *Laws of* 1899.

Abstract II. Series K.

1899.				
Oct. 16.	8	Pay-roll, September, 1899	$399 25	
	9	Fred Batchelor, grass seed	9 00	
	10	William S. Egerton, planting, roads	75 00	
	11	Franklin Pfletcher, grass sod	1 75	
				485 00

Abstract III. Series K.

Date.	No. of Voucher.	Name.	Amount.	
1899.				
Dec. 22.	12	William E. Egerton, planting	$70 30	
	13	Elmanger & Barry, vines	2 88	
	14	Pay-roll, November, planting	645 08	
	15	Fred Batchelor, grass sod	6 00	
	16	Charlotte Haeberle, planting	4 50	
	17	Pay-roll, December, planting	193 02	
				$921 78

Abstract IV. Series K.

Date.	No. of Voucher.	Name.	Amount.	
1900.				
June 20.		The Engineering Record, shelter building	$6 60	
	19	William Pool, shelter building	3 50	
	20	Gazette Publishing Co., shelter building	6 75	
				16 85

Abstract V. Series K.

Date.	No. of Voucher.	Name.	Amount.	
July 28.	21	Journal Publishing Co., shelter building	$6 75	
Sept. 22.	22	Walter Jones, shelter building	17 50	
	23	Cataract Publishing Co., shelter building	2 50	
	24	William Pool, shelter building	1 75	

Date.	No. of Voucher.	Name.	Amount.	
1900.				
Sept. 27.	25	Walter Jones, shelter building	$10 00	
				$38 50
		Payments out of $120,000, as per chapters 419 and 420, Laws of 1900.		
Aug. 31.	1	J. E. Boutrite, arch bridge to Goat Island	$150 00	
	2	H. A. Reid, arch bridge to Goat Island	125 00	
	3	Edward A. Bond, arch bridge to Goat Island	48 36	
	4	D. S. Hollenbeck, arch bridge to Goat Island	18 40	
	5	D. D. Waldo, arch bridge to Goat Island	90 08	
	6	William P. Judson, arch bridge to Goat Island	21 27	
Sept. 22.	7	Engineering News Publishing Co., arch bridge to Goat Island	57 60	
	8	The Engineering Record, arch bridge to Goat Island	36 80	
	9	J. E. Boutrite, arch bridge to Goat Island	17 95	
	10	Edward A. Bond, arch bridge to Goat Island	30 04	
	11	Walter Jones, arch bridge to Goat Island	56 25	

Date.		No. of Voucher.	Name.	Amount.	
1900.					
Sept.	22.	12	Pay-roll, August, 1900, arch bridge to Goat Island....	$397 50	
	27.	13	Walter Jones, arch bridge to Goat Island..........	120 00	
		14	D. S. Hollenbeck, arch bridge to Goat Island...	81 00	
		15	D. D. Waldo, arch bridge to Goat Island	156 96	
		16	Pay-roll, September, 1900, arch bridge to Goat Island	55 50	
	30.	17	W. H. Keepers & Co., first estimate, arch bridge to Goat Island	7,803 00	
		18	W. H. Keepers & Co., second estimate, arch bridge to Goat Island	9,554 00	
				————	$18,819 71

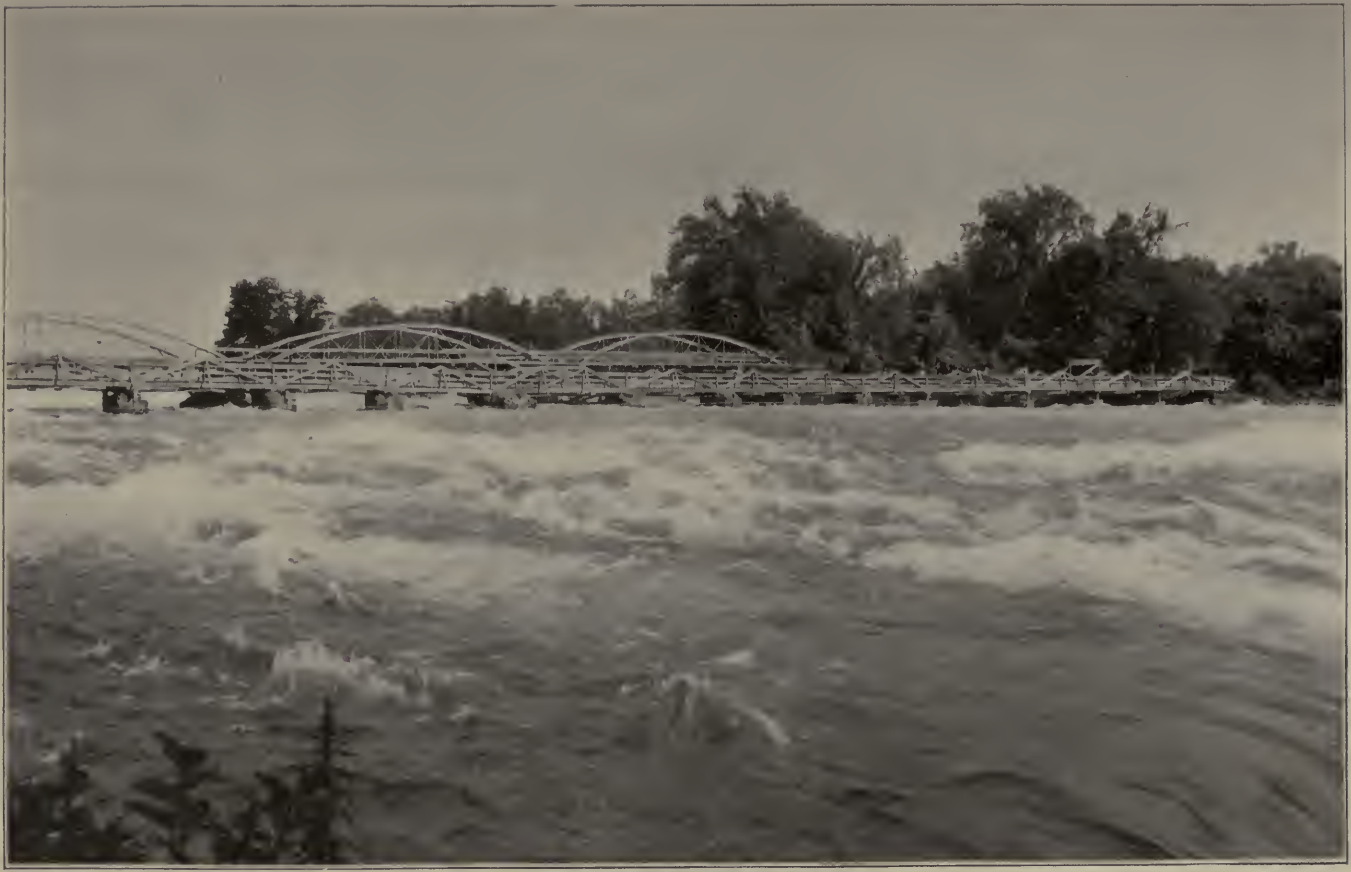
Payments out of $5,000, *as per chapter* 419, *Laws of* 1900.

Abstract I. Series N.

Date.		No. of Voucher.	Name.	Amount.
July	12.	1	Pay-roll June, 1900, Briddle stairs (iron railing, bridges)	$349 75
	18.	2	Dobbie Foundry & Machine Co., iron railings........	307 64
		3	Arthur C. Kugel, iron railing	7 13
		4	P. C. Flynn & Co., iron railing	16 66

Date.	No. of Voucher.	Name.	Amount.
1900.			
Aug. 7.	5	Pay-roll July, 1900 (iron railing, stone stairway)	$702 73
	6	R. D. Young, stone stairway, Goat Island	140 75
	7	Arthur C. Kugel, stone stairway, Goat Island	140 00
	8	F. J. Munson, stone stairway, Goat Island	158 17
	9	Queenston Quarry Co., stone stairway, Goat Island	356 64
Sept. 22.	10	J. H. Cook & Co., stone stairway, Goat Island	15 76
	11	Dobbie Foundry and Machine Co., stone stairway, Goat Island	134 95
	12	Walter Jones, stone stairway, Goat Island	21 25
	13	Elderfield-Hartshorn Co., stone stairway, Goat Island	48 56
	14	William S. Egerton, stone stairway, Goat Island	41 75
	15	R. D. Young, stone stairway, Goat Island	249 50
	16	F. J. Munson, stone stairway, Goat Island	467 10
	17	Pay-roll August, 1900, stone stairway, Goat Island	1,004 62

Date.	No. of Voucher.	Name.	Amount.	
1900.				
Sept. 27.	18.	Pay-roll September, 1900, stone stairway, Goat Island	$53 25	
	19.	Walter Jones, stone stairway, Goat Island	8 00	
				$4,224 21
		Remittances to the State Treasurer:		
1899.				
Nov. 1.		Draft for October receipts	$308 10	
Dec. 1.		Draft for November receipts	78 95	
1900.				
Jan. 2.		Draft for December receipts	35 55	
Feb. 2.		Draft for January receipts	70 20	
March 2.		Draft for February receipts	348 50	
April 2.		Draft for March receipts	251 70	
May 1.		Draft for April receipts	72 10	
June 4.		Draft for May receipts	230 80	
July 2.		Draft for June receipts	645 30	
Aug. 2.		Draft for July receipts	1,612 45	
Sept. 3.		Draft for August receipts	2,809 70	
30.		Draft for September receipts	2,076 45	
				8,539 80
1900.				
April 6.		Check for interest on balances in Manufacturers and Traders' Bank, Buffalo, N. Y.	$6 05	
July 2.		Check for interest on balances in Manufacturers and Traders' Bank, Buffalo, N. Y.	8 07	
				14 12
1900.				
Sept. 30.		Cash balance on hand		37 82
		Total		$58,087 48



Temporary Bridge. Mainland to Green Island.

CLASSIFICATION OF ACCOUNTS.

Maintenance.

Secretary and treasurer, office expenses	$124 77
Secretary and treasurer, salary	1,000 00
Salaries, superintendent and clerk	3,066 65
Police	4,500 00
Inclined railway	2,324 83
Prospect Park	3,356 84
Goat Island	2,075 72
Roads	1,591 02
Walks	1,540 73
Commissioner's expenses	829 43
Superintendent's office expenses	539 62
Water pipes	189 34
Tools	137 90
Electric lighting	650 00
President's office expenses	70 00
Secretary and treasurer, traveling expenses	53 37
Bridges	172 76
Compost	475 25
Coal	148 70
Ice	131 76
Seed	12 50
Buildings	1,896 05
Extra annual reports	45 00
Signs	24 75
Stairways	32 70
	$24,989 69

Improvements under chapter 569, *Laws of* 1899.

Series K.

Grading	$399 25	
Grass sod	16 75	
Planting	962 90	
Roads	25 00	
Vines	2 88	
Shelter building	55 35	
		$1,462 13

Improvements under chapters 419 *and* 420, *Laws of* 1900.

Series L.

Arch bridge, mainland to Goat Island		18,819 71

Improvements under chapter 419, *Laws of* 1900.

Series N.

Iron railing	$669 88	
Biddle stairs	49 50	
Bridges	37 00	
Stone Stairway, Goat Island	3,467 83	
		4,224 21
Total remittances to State Treasurer		8,553 92
Cash balance in hand September 30, 1900		37 82
Total		$58,087 48

PETER A. PORTER, Jr.,
Treasurer.

We, the undersigned, hereby certify that we have examined the foregoing report of the treasurer for the fiscal year ended September 30, 1900, the vouchers and other papers, and we find the report and accompanying documents correct, and that the treasurer has properly accounted for all moneys received and disbursed by him during the fiscal year ended September 30, 1900.

ALEXANDER J. PORTER,
GEORGE RAINES,
Commissioners of the State Reservation at Niagara.

Attest:

CHARLES S. DURKEE,
Professional Accountant and Auditor, Niagara Falls, N. Y.

Report of the Superintendent

OF THE

STATE RESERVATION AT NIAGARA

FOR THE

Fiscal Year Ending September 30, 1900.

Report of the Superintendent.

To the Commissioners of the State Reservation at Niagara:

Gentlemen.—The most important improvements made during the fiscal year ending September 30, 1900, have been the work upon the stone arched bridges from the mainland to Goat Island, and the work upon the new shelter building in Prospect Park. The construction of an iron guard railing, on Luna Island, and the construction of a stone stairway, and observation points, at the American Falls on Goat Island

STONE ARCHED BRIDGES, MAINLAND TO GOAT ISLAND.

June 30th, work of constructing temporary bridges and of removing portions of the whipple truss iron bridges, was commenced. The railings and sidewalks were removed from the iron bridge from the mainland to Green Island. The iron bridge from Green Island to Goat Island was entirely removed.

All the space desired for materials, and every facility possible for the advancement of the work, have been accorded to the contractors. Although a considerable force of men has been employed the work has not progressed as rapidly as expected. No attempt was made to work double shifts during the summer months when the work could be done to advantage. That the contractors came without an adequate plant and without experienced overseers for the work has been evident from the outset.

At the close of the fiscal year the piers and abutments for the bridge from the mainland to Green Island are not in place, and the arches for the bridge from Green Island to Goat Island are unfinished.

Before the winter sets in the bridge from Green Island to Goat Island will probably be completed, excepting the sidewalks and the piers and abutments will be in place for the bridge from the mainland to Green Island.

The iron bridge, from the mainland to Green Island will probably be allowed to remain during the winter for the accommodation of the public.

SHELTER BUILDING, PROSPECT PARK.

The new shelter building was located in Prospect Park between Falls street and Niagara street. Work was begun in August and has progressed steadily since that time. Some delay has been experienced in obtaining the stone for the structure.

The walls are approaching completion, and if the building is enclosed before the winter sets in it can be completed within the contract time. .

STONE STAIRWAY, GOAT ISLAND.

The wooden stairway at the American Falls on Goat Island has been removed and a substantial stone stairway constructed.

There are 57 steps of Queenston stone, 10 feet wide, 14-inch tread, and 6-inch rise, laid in Portland cement, on stone foundations 4 feet deep, so as to be below the frost line. There are four flights of stairs slightly winding, and three spacious landings, for rest and observation. An iron guard railing has been

AMERICAN FALLS, FROM GOAT ISLAND.

erected on the side towards the high bank, of the river and a rustic embankment constructed on the other side. The margins of the stairway have been graded and covered with sod and will be planted with vines and trailing plants the coming spring.

OBSERVATION POINTS.

The walk and look-out at the foot of the stone stairway on Goat Island have been raised from 1 to 6 feet, and an iron guard railing constructed. Observation points have also been constructed at the top of the stairway on each side of the entrance, and the iron guard railing adjusted to the new arrangement.

The curbing and paving at the carriage turn-out near the top of the stairway have been taken up and are being replaced at a point about 50 feet further distant from the entrance to the stairway, and the observation points for visitors at the American Falls on Goat Island.

IRON GUARD RAILING, LUNA ISLAND.

The old guard railing on Luna Island has been removed and a new iron railing of the pattern designed by Mr. Calvert Vaux, substituted. The standards are bolted to stone flags, laid in concrete. There are no straight lines in the railing. The new railing is safer and more sightly than the one removed.

PAVING BUFFALO AVENUE.

Buffalo avenue, between Mill slip and First street, adjacent to the Reservation, has been paved with asphalt by order of the city of Niagara Falls. Buffalo avenue, between Seventh street and the eastern terminus of the Reservation, has also been paved with macadam by direction of the city authorities.

The paving of Buffalo avenue made it necessary to raise the grade of First street within the Reservation about 2 feet.

Filling and grading were also required back of the curb on the Green below First street.

Advantage was taken of the paving of Buffalo avenue to obtain material for filling the low places along the riverway and on the terrace and on Willow Island.

Some filling and grading has also been done on the uneven open space adjacent to the Loop driveway at Port Day.

SUSPENSION BRIDGES TO SISTER ISLAND.

Several examinations of the Suspension bridges to the Sister Islands have been made by the State Engineer. Plans and specifications for the repairs of the bridges were received. After a subsequent examination requested by the Board, the plans and specifications were returned to the State Engineer for revision and no further action has been taken

It may be desirable to abandon the idea of repairing the present bridges and to apply to the Legislature for an appropriation for stone arch bridges to the Sister Islands, in keeping with the bridge to the first island already constructed.

PUBLIC CARRIAGE STANDS.

The public carriage stands on the reservation were abolished May 26th in accordance with the resolution adopted by the Board. A copy of the resolution was mailed to each driver of a licensed carriage. The drivers have complied with the requirements almost without exception.

The licensing of improper persons, by the city government necessitated the abolition of the carriage stands.

During the year two licensed carriage drivers have been excluded from the Reservation for violation of the ordinances.

RESERVATION CARRIAGE SERVICE.

During the progress of the work upon the arched bridges to Goat Island the Reservation carriage service has been operated by placing horses and carriages on Goat Island.

The Reservation Carriage Service Company has been notified to deliver passengers only on the river side of the Riverway and to use the Reservation carriages for hire only within the Reservation.

The Reservation carriage service should be operated without combination of any kind with any other local business enterprise.

THE BIDDLE STAIRS.

Repairs have been made upon the Biddle Stairs and the steps leading to them. The structures are so old and unsuitable that the question of their public use after the present season, is respectfully submitted to the Board for consideration.

COVERING CRIBWORK GOAT ISLAND.

A large number of the sumacs that were rapidly spreading over the upper end of Goat Island have been removed. The timber docking and cribwork along the southern shore of Goat Island have been covered by the sumacs removed and by brush collected in the thicket on Goat Island so as to be invisible, restoring the natural appearance of the shore.

The banks adjacent to the cribwork have been planted with Virginia creepers and willows.

900 900

Niagara Fall

ELECTRIC RAILWAY ON THE RIVERWAY.

The work of laying a single track for the electric cars on the riverway was commenced November 13, 1899. The cars are run on the riverway only a portion of one block between Falls avenue and the entrance to the International Steel Arch Bridge.

The cars have been in operation nearly a year under regulations formulated by the Board.

Connecting the railway systems at the foot of Falls street and at the Steel Arch Bridge, has been a great convenience to visitors to the Falls. There is not the entire freedom for vehicles formerly enjoyed in that part of the riverway, but aside from that the Reservation has suffered no injury. The operation of the cars as a rule, has been satisfactory, proving the wisdom of the State in retaining the ownership of the track and the absolute control of the operation of the cars within the distance traveled inside the Reservation.

ELECTRIC RAILWAY STATION.

The site for the railway structure proposed to be built by the Electric Railway Company on the riverway has been cleared and sketches for the building have been submitted, but the structure has not yet been erected.

The station should be dignified and substantial with architectural character worthy of so prominent a location.

GRADING AND PLANTING.

Planting has been done in Prospect Park on the Riverway on Green Island and at the entrance to Goat Island. A list of the trees, shrubs and vines planted is herewith submitted.

A large number of dead trees and tree stumps in Prospect Park have been grubbed out and removed.

The riprapping of the river shore at Fourth street with large stones has been completed and the ground made by filling, graded, sown with grass seed and planted with trees and shrubs.

The riprapping, grading and planting at the new stone arch bridge to the First Sister Island has been completed.

A large quantity of compost for the lawns which had been collected in the gravel pit on Goat Island during the summer and turned and mixed from time to time was spread upon the lawns during the winter months.

The fountain in Prospect Park has been taken down, the basin removed, and the locality filled and graded.

ROADS.

A heavy covering of gravel has been placed on the Riverway the entire distance from Falls avenue to First street, and from the entrance to the Steel Arch Bridge at Niagara street. Extensive repairs have been made to the roads on Goat Island, and the carriage turn-out at the Inclined Railway has been graveled.

The margin of the Riverway between the Steel Arch Bridge and Niagara street has been filled and covered with sod, and a low section of Prospect Park where the water lodged in the spring and fall has been filled.

The carriage turn-out at the Three Sister Islands should be enlarged and the walks through it changed before another season.

The artificial banks beside the road in Prospect Park have been graded to a natural slope and the road widened at the Niagara street entrance.

The head of Green Island, where erosion took place during the winter, has been riprapped with large stone.

The shrubs in the nursery have been transplanted and rearranged. Cuttings of Virginia creepers, bitter sweet and other native plants have been planted in the nursery for propagation. A screen of evergreens has been planted on Goat Island to shut out the view of the lumber yard from the driveway.

A bay in the pond in Prospect Park, in which the water was stagnant, has been filled.

WALKS.

A gravel walk, eight feet wide, has been constructed on the Riverway, from the entrance to the Steel Arch Bridge to the northern terminus of the Reservation at Niagara street.

Gravel walks in Prospect Park, on the Riverway and on Goat Island have been repaired.

EXAMINATION OF STRUCTURES BY STATE ENGINEER.

The superintendent communicated with the State Engineer and Surveyor, as directed by the Board, concerning the examination of the bridges and structures on the Reservation.

December 27th to 31st, inclusive, a careful examination was made by C. T. Middlebank, C. E., of the State Engineer's Department. The report made upon such examination by W. R. Davis, chief bridge designer, is herewith submitted.

The report substantially recommended the removal of the iron bridges, the Biddle Stairs and the building covering the Inclined Railway, and substitution of more substantial structures.

THE INCLINED RAILWAY.

The tracks and machinery of the Inclined Railway have been examined and repaired. After being in use only three months, the manilla cable of the Inclined Railway was found to be defective. It was removed, an old cable substituted and a new cable was ordered and received and was attached to the cars. The defective cable has been returned with a claim for an allowance on the new cable.

Many of the timbers in the roadbed of the Inclined Railway should be renewed. The frame structure covering the Inclined Railway should also be renewed.

An elevator shaft in the locality would be less obtrusive than the Inclined Railway structure and would afford less lodgment for the ice in the winter season. The enormous accumulation of frozen spray on the present structure is a great element of danger and expense every winter. In making changes in the locality it would be well to consider the advisability of substituting an elevator for the present Inclined Railway.

STEAMBOAT LANDING.

During the year the steamboat landing has been leased to the Maid of the Mist Steamboat Company, which has kept the landing in repair.

Only one boat has been in operation.

BRIDGES.

The roadway of the Boulder Bridge on the Riverway has been covered with a heavy coating of cement to prevent the soakage of water through the masonry of the arch.

The foundations of the retaining walls at the rustic stone bridge, at the weir below First street, have been repaired.

GUARD RAILINGS.

The iron guard railings in Prospect Park and along the high bank on Goat Island and Luna Island and at the Stone Stairway have been painted.

WATER PIPES.

The water pipes conveying the supply for the roads and buildings on Goat Island have been removed from the iron bridges to the temporary bridges and arrangements made for supplying the bridge contractors with water for their work.

The water pipes on the surface of the ground, the standpipes for sprinkling the roads and the drinking fountains have been disconnected for the winter season.

BUILDINGS.

The roof of the terminal station at the foot of the Inclined Railway has been repaired in places where it was damaged by the ice during the winter.

April 16th the gable on the northern side of the lower terminal station was torn off by the ice. The damage has been repaired. The structure covering the Inclined Railway has been repainted. The cottage on Goat Island has been reshingled. The slat sides and ends have been removed from the Shelter Building at the Three Sister Islands and the structure repainted.

The Inclined Railway building and the pavilion in Prospect Park have been repainted. The pavilion building should be reshingled the coming spring.

The gate house and summer house in Prospect Park, the shelter building at the Horse Shoe Falls, the police booth on Green Island, the structures at the Cave of the Winds building and the park seats and tables have been repainted.

The park seats and tables have been stored in the open pavilion in Prospect Park and on Goat Island for the winter season.

Terrapin Bridge. Goat Island.

VISITORS.

The number of persons who visited the Reservation during the fiscal year is estimated at 750,000. Of this number 456,249 came in "excursion" parties. A statement of the excursions to the Reservation during the year is hereto appended.

EMPLOYEES.

The number of regularly classified employees is nine, to wit: 1 superintendent, 1 treasurer and secretary, 1 clerk, 2 police and caretakers, Goat Island; 3 police and caretakers, Prospect Park; 1 Inclined Railway police and caretaker.

A statement of the number of laborers and teamsters employed each month is herewith submitted.

STATEMENT OF NUMBER OF EMPLOYEES.

Maintenance Rolls.

1899.	Foreman.	Asst. foremen.	Teamsters.	Laborers.
October	1	3	1	17
November	....	3	....	18
December	1	3	1	13
January	1	3	2	18
February	1	3	2	19
March	1	2	1	14
April	1	3	2	38
May	1	3	1	31
June	1	2	1	24
July	1	2	1	35
August	....	1	1	28
September	....	1	....	6

Improvement Rolls.

1899.	Foreman.	Asst. foreman.	Teamsters.	Laborers.
Chapter 569 of the Laws of 1899.				
November	1	....	2	19
December	....	....	1	23
Chapter 419, Laws of 1900.				
June	1	1	1	6
July	1	2	3	17
August	1	3	3	20
September	1	2	1	18
Chapter 420, Laws of 1900.				
August	....	....	....	8
September	....	....	....	9

Detailed statements of the receipts and expenditures of the superintendent, the amount of the pay-rolls for each month and the classification of the pay-rolls and accounts are hereto appended.

Respectfully submitted,
THOMAS V. WELCH,
Superintendent.

EXCURSIONS.

OCTOBER, 1899, TO SEPTEMBER, 1900, INCLUSIVE.

1899.			Cars.	Persons.
Oct.	6.	Special party from Philadelphia..	5	300
		Boston, Mass., Knights of Columbus..........................	1	25
	8.	Cleveland and Erie, Pa...........	50	3,000
	11.	National Druggists' Association..	10	600
	12.	Pennsylvania Superintendents of Poor..........................	6	360
		Special Mexican party...........	1	60
	15.	Buffalo, N. Y., and Cleveland, O...	30	1,800
	20.	Baltimore and Washington.......	8	480
1900.				
Jan.	14.	Buffalo, N. Y....................	5	300
Feb.	4.	Buffalo, N. Y....................	10	600
	7.	Buffalo, N. Y....................	6	360
	11.	Buffalo, Rochester and Lockport, N. Y..........................	30	1,800
	18.	Buffalo, Rochester and Lockport, N. Y..........................	20	1,200
March	4.	Buffalo, Rochester and Lockport, N. Y..........................	15	900
	11.	Buffalo, Rochester and Lockport, N. Y..........................	15	900
	18.	Buffalo, N. Y....................	10	600
	25.	Buffalo, N. Y....................	12	720

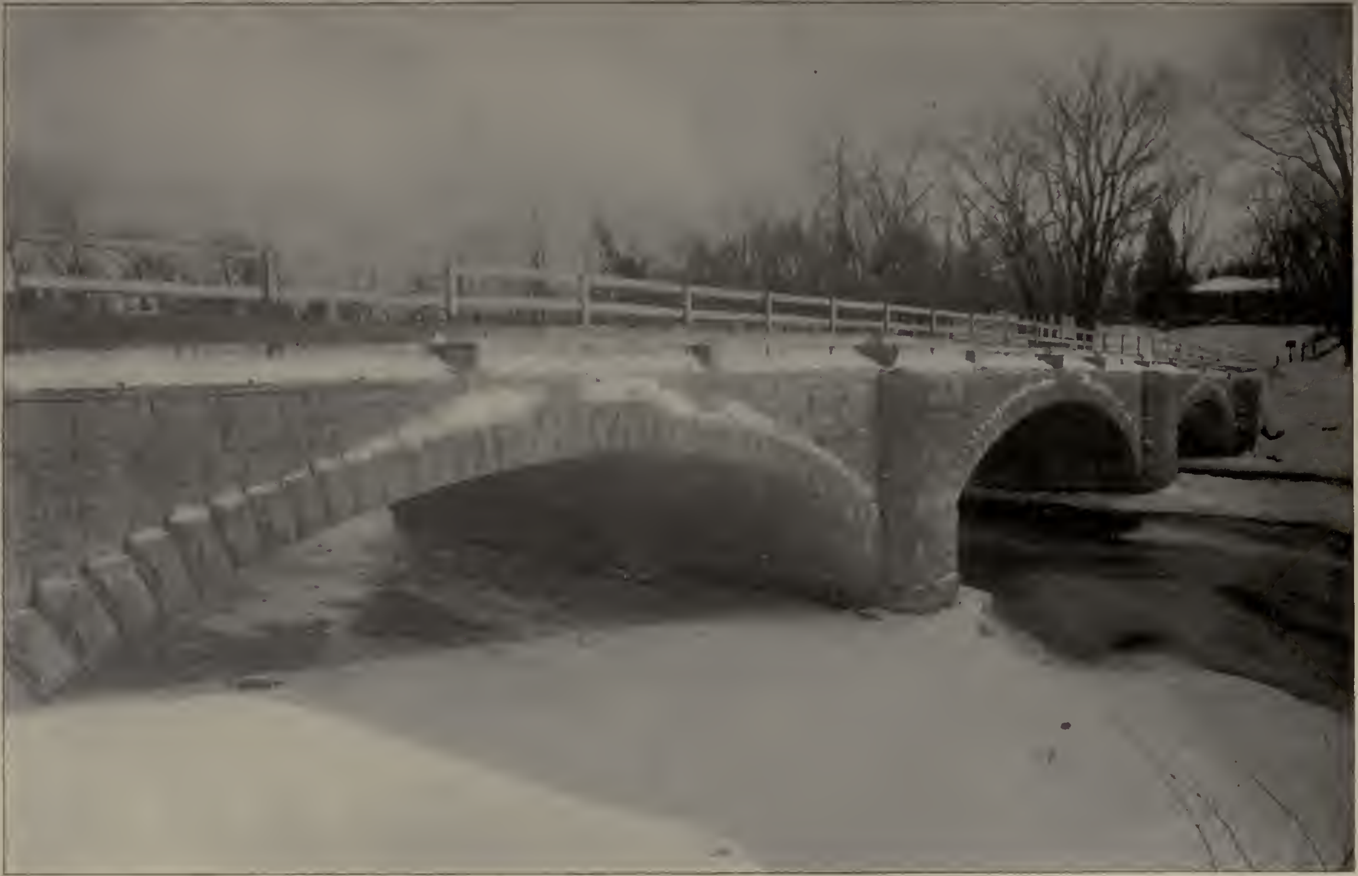
1900.			No. of cars.	Persons.
May	5.	Lockport, N. Y., Arbor Day.......	10	600
	11.	Buffalo, Central High School.....	4	240
	14.	Norwegians from Minnesota to Europe......................	10	600
	16.	Rochester, N. Y., the Eagles......	4	240
	24.	Queen's birthday excursion.......	30	1,800
June	1.	Detroit, Mich., Coal Dealers......	2	120
	3.	Detroit, Mich., Coal Dealers......	2	120
		Sunday excursions	20	1,200
	4.	Canadian Editorial Ass'n........	2	120
		Butchers' Convention	10	600
	5.	American Pattern Makers........	3	130
		Canadian Press Ass'n............	2	120
		N. Y. State Butchers' Ass'n......	3	180
	9.	Union Sunday Schools, Hamilton, Ont.........................	2	120
		Dunkirk, N. Y..................	12	720
		City officials, Allegheny, Pa......	2	120
	10.	Sunday excursions (all sources)...	65	3,900
	12.	Bradford, Pa.	8	480
		City officials, Toronto, Ont., and friends......................	3	180
	13.	Buffalo, N. Y., Knights of Honor..	2	120
		Pennsylvania R. R. officials and newspaper men	3	180
		Toronto, by boat	......	200
	14.	Pennsylvania R. R. officials.......	6	360
		Strathroy, Ont.	7	420
		Stratford, Ont.	4	240

1900.			No. of cars.	Persons.
June	15.	Buffalo, N. Y., Wholesale and Retail Coal Dealers	3	180
	16.	Hamilton, Ont., Tailors' Union	7	420
		Buffalo Coal Dealers	14	840
		Delegates to Philadelphia Convention	10	600
		Toronto, Ont., by boat	......	100
	17.	Carbondale, Pa.	10	600
		Western N. Y. & Pa.	10	600
		Cleveland, Ohio	10	600
		Rochester and Buffalo, N. Y.	141	8,420
		Niagara on the Lake, Canadian militia	......	2,000
		Susquehanna	9	540
	18.	Topeka, Kan. (Turnverein)	1	60
		Milwaukee, Wis. (Turnverein)	1	60
	19.	Teachers and Scholars, Public Schools, Cleveland, O.	6	360
		Toronto, Ont., by boat	......	75
	20.	Toronto, Ont., by boat	......	200
	21.	Epworth League, Rochester, N. Y.	5	300
		McCaul, M. E. Church, Toronto, Ont	4	240
		Epworth League, by boat, Toronto, Ont	......	400
		Niagara on the Lake Ontario, Canadian militia	......	500
	22.	Toronto, Ont., by boat	......	100
	23.	Hornellsville, N. Y.	9	540
		Saturday half-holiday excursion	10	600

1900.			No. of cars.	Persons.
June	23.	English Paper Manufacturers	1	60
		Hamilton, Ont., brewers	8	480
		Orangeville, Ont., Foresters	9	540
		Mooneyville, Ont., by boat	......	950
	24.	Sunday excursions	167	10,000
	26.	Carlton M. E. Church, Toronto, Ont., by boat	......	900
	27.	Baptist Church, Toronto, Ont., by boat	......	275
	28.	Buffalo, N. Y., Miss Remington's School	2	120
		Delegates to National Saengerbund	1	60
		Homeopathists, en-route to Paris.	2	120
		Lockport, N. Y., Thursday Club	1	60
		Toronto, Ont., by boat	......	525
	30.	Delaware, Lackawanna & Western	16	960
		Half-holiday excursions	20	1,200
		Maine, H. H. Delegates to Kansas Convention	1	60
July	1.	Rochester, N. Y.	12	720
		Cleveland, O	10	600
		Buffalo, N. Y.	60	3,600
	2.	Dominion Day excursions from Canada	140	8,400
		Toronto, by boat	......	4,000
	3.	Railroad employees, T. H. & B. Line	8	480
		Toronto, by boat	......	125
	4.	From all sources	250	15,000

1900.			No. of cars.	Persons.
July	5.	Presbyterian Sunday School, Toronto, by boat	......	554
	6.	Methodist Sunday School, Toronto, by boat	......	750
	7.	National Confectioners' Convention	2	120
		Saturday half-holiday excursions	40	2,400
		Employees, Mathew Harris, Hamilton, Ont	10	600
		Toronto, Ont., Foresters, by boat	......	400
	8.	Sunday excursions, all sources	85	5,100
	9.	Kansas, Neb., Delegates returning	2	120
		Chautauqua, N. Y.	4	240
		National Whist Players Convention	6	360
	10.	Employees, International Traction Co	12	720
		Toronto, Farmers' Institute, by boat	......	900
	11.	Washington, Ohio, Grocers	7	420
		American Knife Mfrs	1	60
		Buffalo, N. Y., Feohsein Bowling Club	1	60
		Toronto, Ont., by boat	......	100
	12.	Carbondale, Pa	6	360
		Rochester, N. Y.	2	120
		Buffalo Traction Co.'s employees	15	900
		Welland, Ont., Orangemen	28	1,680
		Toronto, by boat	......	500
	13.	Grand Trunk R. R., employees	84	5,040

1900.			No. of cars.	Persons.
July	13.	Buffalo Traction Co., employees...	9	540
		Main line, Erie R. R.............	16	960
		Lehigh Valley R. R..............	8	480
	14.	Cincinnati, Ohio	17	1,020
		Chautauqua, N. Y...............	7	420
		Saturday half holiday excursions.	40	2,400
		Toronto Brantford, Waterloo, Ont.	36	2,160
		Toronto, by boat, Plumbers......	......	3,000
	15.	Pittsburg, Pa....................	18	1,080
		Sunday excursions, all sources....	90	5,400
	16.	Guelph, Ont......................	8	480
		Buffalo, N. Y. Traction Co.'s employees	17	1,020
	17.	National American Paper Box Makers	2	120
		Pittsburg, Pa....................	10	600
		Detroit, Mich., Glass Blowers....	4	240
		St. Mary Magdalene Church, Toronto, Ont......................	6	360
	18.	Hamilton, Ont., Grocers' Union...	117	7,020
		Toronto, Ont., by boat...........	......	5,000
	19.	Bradford, Pa....................	7	420
		Jamestown, N. Y................	10	600
		Buffalo, N. Y., Traction Co.'s employees	14	840
		Daughters of Rebecca............	......	200
		Toronto, Ont., by boat...........	......	4,000
	20.	Cleveland, O....................	8	480
		Baltimore and Washington......	12	720
		Toronto, Ont., by boat...........	......	500



BRIDGE. GREEN ISLAND TO GOAT ISLAND.
Partly completed, February, 1901.
Looking up stream.

1900.		No. of cars.	Persons.
July 21.	Cleveland and Detroit...........	16	960
	Saturday half-holiday excursions..	45	2,700
	Lancaster, N. Y.................	2	120
	Hamilton, Ont., Clothiers' Union..	6	360
	Grand Trunk Railroad employees.	60	3,600
22.	Pittsburg, Pa....................	10	600
	Wheeling, W. Va.................	10	600
	Cleveland, O....................	12	720
	All other sources...............	120	7,200
23.	Western N. Y. and Pennsylvania excursion	10	600
	Other sources....................	10	600
	Toronto, Ont., by boat...........	......	500
24.	Toronto, Ont., by boat, Odd Fellows	......	1,100
25.	R. W. & O., main line...........	18	1,080
	St. Thomas, Ont., Grocerymen....	17	1,020
	Toronto, Ont., Foresters, by boat.	......	1,200
26.	Olean, N. Y.....................	9	540
	St. Thomas, Ont.................	17	1,020
	Toronto, Ont., by boat...........	......	700
27.	Buffalo, N. Y., Public Schools Nos. 3, 42 and 44...................	9	540
	Washington and Baltimore......	20	1,200
	Ohio and Indiana................	30	1,800
	Toronto, Ont., Baptist Church....	4	240
	Hamilton, Ont...................	18	1,080
28.	Batavia, N. Y....................	60	3,600
	Pittsburg, Pa....................	30	1,800
	General half holiday excursion....	65	3,900

1900.			No. of cars.	Persons.
July	28.	Hamilton, Ont.	30	1,800
		Toronto, Ont., by boat	......	2,000
	29.	Buffalo and Rochester, N. Y.	90	5,400
		South Bend, Ind. and Cleveland, O.	30	1,800
		Pittsburg, Pa	10	600
		Phi Gamma Delta Fraternity	3	180
	30.	Guelph, Ont., Foresters	34	2,040
		Toronto, Ont., by boat	......	900
	31.	Jamestown, N. Y	9	540
		Buffalo, N. Y	10	600
		Toronto, Ont., by boat	......	500
Aug.	1.	Toronto, Ont., by boat	......	700
		Owen Sound, Ont., by boat	......	600
	2.	German Lutheran Church (city)	9	540
		Lockport, N. Y., Congregational Church	5	300
		Toronto, Ont., by boat	......	1,000
	3.	Washington and Baltimore	14	840
		Philadelphia and Reading	20	1,200
		M. C. and Lehigh Valley railroads	140	8,400
		Lake Erie and Western Railroad	40	2,400
		Cincinnati and Columbus, Ohio	40	2,400
		Buffalo, N. Y	20	1,200
	4.	Chautauqua, N. Y	9	540
		Hamilton, Ont	10	600
		Port Jervis, Ont	18	1,080
		Saturday half holiday excursion	30	1,800
	5.	Paris, Ont., Wholesale Grocers	5	300
		Cleveland, Ohio	10	600

1900.		No. of cars.	Persons.
Aug.	5. Buffalo, Lockport and Rochester, N. Y.	167	10,020
	R., W. & O. main line	8	480
	6. Chautauqua, N. Y.	8	480
	Woodstock, Ont., Foresters	7	420
	7. Western points	10	600
	Buffalo, N. Y.	15	900
	Hamilton, Ont., Odd Fellows	10	600
	Toronto, Ont., by boat	......	7,000
	8. Niagara County Veterans	15	900
	National Ass'n Window Trimmers	3	180
	Big Four excursion	20	1,200
	Chautauqua, N. Y.	9	540
	Firemen's Convention	74	4,440
	Toronto, Ont., by boat	......	520
	9. Buffalo, Rochester and Pittsburg.	10	600
	Canadian Brotherhood Locomotive Engineers	5	300
	Main line W. N. Y. & Pa	9	540
	Main line C., H. & D.	18	1,080
	Wabash line	16	960
	Other sources	20	1,200
	Toronto, Ont., by boat	......	1,000
	10. Michigan Southern R. R.	30	1,800
	Buffalo, N. Y.	40	2,400
	Grand Rapids, Mich.	18	1,080
	Hamilton, Ont.	10	600
	Toronto, Ont., by boat	......	800
	11. Main line, R., W. & O.	16	960
	St George's, Ont.	25	1,500

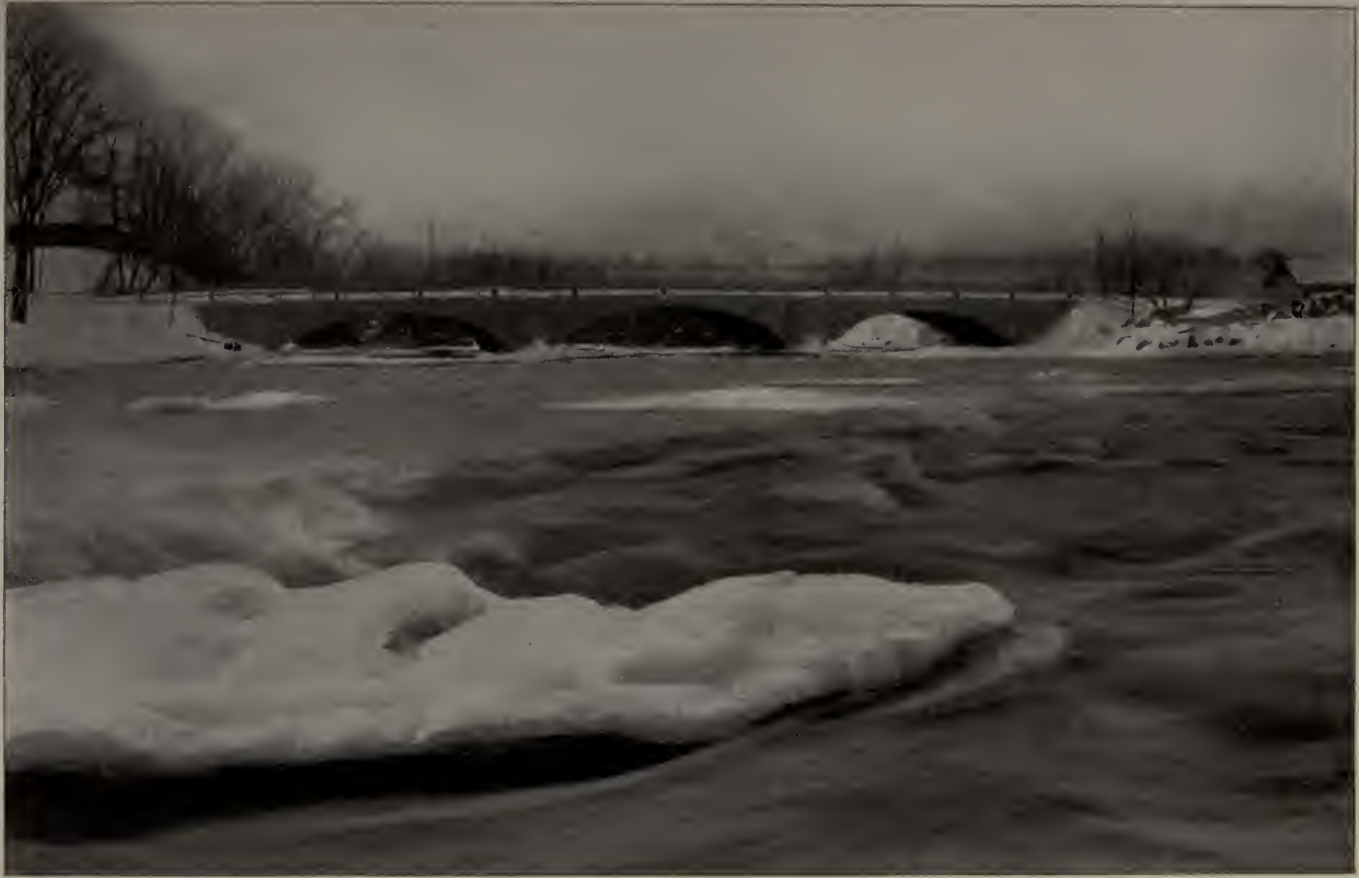
1900.			No. of cars.	Persons.
Aug.	11.	Stony Creek, Ont	20	1,200
		Saturday half-holiday excursion	60	3,600
		Toronto, by boat	......	1,500
	12.	Main line N. Y. C. and Buffalo	115	6,900
		Cincinnati, Ohio	23	1,380
		Cleveland, Ohio	14	820
	13.	Woodstock and Hamilton, Ont	34	2,040
		Lakewood, N. Y	8	480
		Toronto, Ont., by boat	......	500
	14.	Chautauqua, N. Y	8	480
		Syracuse and Auburn	10	600
		Pittsburg, Pa	12	720
		Cleveland, Ohio	10	600
		Buffalo, N. Y	30	1,800
		Toronto, Ont., by boat	......	500
	15.	Western points	75	4,500
		Elmira, N. Y	10	600
		Cleveland, Ohio	10	600
		Toronto, Ont., Hibernians	34	2,040
		Canadian Pacific and boat	20	1,200
	16.	Lockport, N. Y., Lutheran Church	4	240
		Buffalo and Rochester	40	2,400
		N. Y. C. & H. R. R. R	30	1,800
		W. N. Y. & Pa	18	1,080
		Pennsylvania R. R	20	1,200
		D., L. & W	20	1,200
		Clover Leaf line	20	1,200
	17.	All sources	202	12,120
		Orangeville, Ont., by boat	......	6,000
	18.	T., H. & B. R. R	27	1,620

1900.			No. of cars.	Persons.
Aug.	18.	Chautauqua, N. Y.	8	480
		Saturday half-holiday excursion	40	2,400
	19.	Jamestown, N. Y.	8	480
		N. Y. C., W. S. and C. & B.	100	6,000
		Nickel Plate line	20	1,200
	20.	Wisconsin Press Ass'n	2	120
		Kingston, Ont., by boat	......	700
	21.	Brandford and Simcoe, Ont	20	1,200
		National Florists' Convention	2	120
		Chautauqua, N. Y.	7	420
		Youngstown	8	480
	22.	L. S. & M. S. R. R.	9	540
		Chautauqua, N. Y.	4	240
		Buffalo, N. Y.	15	900
		Toronto, Ont., by boat	......	200
	23.	Black Rock Union School	4	240
		Albion, Brockport and Rochester	16	960
		Main line, Nickel Plate	12	720
		Cleveland and Buffalo	12	720
		St. Thomas, Ont	34	2,040
	24.	Philadelphia and Washington	20	1,200
		Brooklyn, N. Y., G. A. R.	9	540
		Grand Island Evangelical Church	3	180
		Toronto, Ont., by boat	......	200
	25.	Brooklyn, N. Y., G. A. R.	20	1,200
		Maine and New Hampshire G. A. R.	9	540
		Hamilton, Ont	16	960
		Saturday half-holiday excursion	25	1,500
		Toronto, Ont., by boat	......	200

1900.		No. of cars.	Persons.
Aug.	26. Knights of Pythias..............	4	240
	Sunday excursions	80	4,800
	St. Catherines, Ont..............	8	480
	27. Erie, Pa.........................	10	600
	27. Jamestown, N. Y...............	4	240
	28. Main line Pa. R. R...............	12	720
	Chautauqua, N. Y. Society of Friends	5	300
	Pennsylvania (special excursion).	40	2,400
	Elmira, N. Y..................	14	840
	Jamestown, N. Y................	6	360
	29. Toronto, Ont. (annual fair)......	30	1,800
	Toronto by boat.................	......	1,300
	30. Allegany Valley	12	720
	Toronto, Ont...................	15	900
	Lancaster, Pa...................	14	840
	Toronto by boat................	......	300
	31. Knights of Pythias..............	5	300
	Philadelphia and Baltimore......	20	1,200
	All other sources	50	3,000
Sep.	1. G. A. R. en route to Philadelphia..	8	480
	New York city	10	600
	Saturday half-holiday excursion..	75	4,500
	Toronto, by boat	......	900
	2. Baltimore, Washington and Philadelphia	20	1,200
	Lake Erie and Western R. R.....	15	900
	Buffalo, Rochester, etc..........	85	5,100
	3. New York, Mozart Verein	4	240
	Rochester, Syracuse and Lockport	65	3,900

1900.		No. of cars.	Persons.
Sept.	3. R. W. & O. & L. S. & M. S.	30	1,800
	Buffalo, N. Y.	20	1,200
	Scranton, Pa.	10	600
	Hornellsville, N. Y.	10	600
	Toronto, Ont., by boat	......	3,000
	4. Cleveland, O.	5	300
	W. N. Y. & P. Line	9	540
	Chicago, Ill.	18	1,080
	Toronto, Ont., by boat	......	900
	5. Mansfield and Toledo, O.	14	840
	Pittsburg, Pa.	12	720
	Philadelphia, Washington and Baltimore	20	1,200
	Toronto, Ont.	25	1,500
	Nickel Plate R. R.	10	600
	California (Special Party)	2	120
	Hamilton, Ont.	20	1,200
	Toronto, Ont., by boat	......	1,600
	6. Canton, O.	14	840
	Toronto, Ont., by boat	......	5,000
	7. G. A. R. returning	1	60
	Toronto, Ont., by boat	......	1,500
	8. Nickel Plate R. R.	20	1,200
	Detroit, Mich., Mail Carriers	9	540
	Saturday half-holiday excursions	10	600
	Toronto, Ont., cars and boat	10	1,500
	9. M. S. & L. S.	21	1,260
	Sunday excursions	45	2,700
	10. Toronto, Ont., by boat	......	900
	11. Fire Underwriters Convention	5	300

1900.		No. of cars.	Persons.
Sept.	11. Laundry Men's Association......	5	300
	12. National Association, Embalmers	5	300
	Braumeisters' Convention	8	480
	Simcoe, Ont.	12	720
	12. Buffalo, N. Y., C. M. B. A. Society.	4	240
	13. Insurance agents	3	180
	Toronto, Ont., by boat..........	......	300
	14. Baltimore, Washington and Philadelphia	16	960
	Toronto, Ont., by boat...........	......	250
	16. Nickel Plate R. R...............	10	600
	L. S. & M. S. R. R................	10	600
	Rochester, Lockport and Buffalo.	15	900
	17. Toronto, Ont., by boat...........	......	200
	19. Street Railroad Association	4	240
	Toronto, Ont., by boat..........	......	200
	20. Carbondale, Pa.	6	360
	Scranton, Pa.	6	360
	Hornellsville, N. Y..............	5	300
	21. Washington and Baltimore......	8	480
	Toronto, Ont., by boat..........	......	350
	22. Port Jarvis	4	240
	23. Rochester, Syracuse and Buffalo..	32	1,920
	24. Stratford and Galt, Ont., Methodist churches	10	600
	St. Catherines, Ont.............	3	180
	25. Coushohocton, Pa., Firemen.....	1	60
	Emporium, Pa.	5	300
	26. New York (Special Party).......	2	120
	St. Catherines, Ont.............	3	180



BRIDGE. GREEN ISLAND TO GOAT ISLAND.
Partly completed, February, 1901.
Looking down stream.

1900.		No. of cars.	Persons.
Sept. 26.	Toronto, Ont., by boat	......	600
27.	North Carolina Press Association	2	120
	Washington, Baltimore and Philadelphia	9	540
	St. Catherines, Ont	4	240
	Toronto, Ont., by boat	......	250
28.	Newfane, N. Y., Basket Factory employees	2	120
30.	Buffalo, N. Y	20	1,200
	Rochester, N. Y	6	360
	St. Catherines, Ont	5	300
		6,389	456,249

RECAPITULATION.

1899.		
October	111	6,625
November	......	....
December	......	....
1900.		
January	5	300
February	66	3,960
March	52	3,120
April	......	....
May	58	3,480
June	636	44,325
July	2,055	150,229
August	2,559	176,540
September	847	67,670
	6,389	456,249

THE STORY OF NIAGARA

BY

PROF. C. H. HITCHCOCK.

Reprinted from the *American Antiquarian*, January, 1901.

THE STORY OF NIAGARA.

BY C. H. HITCHCOCK, LL. D.

[Reprinted from the American Antiquarian, January, 1901.]

There is, so far as is known, no better locality than the region of the Niagara gorge to afford an insight into the length of time that has elapsed since the disappearance of the ice-sheet from the northern United States. At first it was thought to be a very simple problem. Given a gorge seven miles long, known to be lengthening annually by a definite number of feet and inches, we can ascertain the number of years required by dividing the sum total of feet by the annual recession. This result is believed to represent the period that has elapsed since the ice age, because the Niagara River commenced its existence in consequence of the damming of the ancient Erie (Erigan) River. The original channel having been blocked, Lake Erie accumulated, and its lowest line of exit was by way of the Niagara River. Sir Charles Lyell in 1841 estimated this period to have been about 36,000 years. He supposed the annual wear to be one foot. The latest figures indicate the amount of recession to be four times as great. Hence, if there were nothing more to be said, our conclusion must be that the time needed was only one-fourth of 36,000.

But this estimate must be modified by a careful consideration of various factors. It must be conceded that the Niagara River began to flow only after the obliteration of the Erigan Channel. Then the peculiar elbow at the whirlpool indicates a second blockade, and consequent divergence of the river toward Lewiston; for in none of the numerous canons of the West do we find any such arrangement. The gorge varies greatly in width and depth, as if the volume of the river had been diminished at times. Again, the work may have been interrupted by another glacial blockade, or modified by the presence of lakes not now existent. The story of the gorge, then, shows much complication. It will be our task to state what the principal events in the history of this region have been, so as to be able to judge of the value of computations based upon the work performed.

There is no lack of literature pertaining to this subject. The facts are of very easy apprehension; hence a multitude of authors, attracted by the sublimity of the roaring cataract, have placed their opinions upon record. Several hundred titles of these writings might be enumerated—of travellers, historians, poets, artists, statesmen, generals, divines, besides professional physicists and geologists. Among those worthy of special mention are the early pictures by Father Hennepin, as seen in 1678; by Peter Kalm in 1751; by Capt. Basil Hall in 1827 with a camera lucida; by famous artists, Church and Bierstadt, and finally by the photographer with the best of modern appliances. Bird's-eye views, with the geology, or estimates of age, came from Robert Bakewell, Jr., in 1830; Sir Charles Lyell, 1841; Prof. James Hall, 1843; Dr. Julius Pohlman, 1888, and others The two more recent authors, who have surpassed all others by their discernment and brilliant suggestions, are Drs. J. W. Spencer and G. K. Gilbert in their writings during the past twenty years. Stations for the accurate measurement of the recession were established by James Hall in 1842; verified and observed by the United States Lake Survey in 1875, R. S. Woodward in 1886, and A. S. Kibbe in 1890. An altogether different class of papers relate to the use of the power derived from the falling water, and its transmission to great distances.

Niagara River is a part of the St. Lawrence system of drainage, commencing with the five great lakes, Superior, Michigan, Huron, Erie, and Ontario, having an area of 94,650 square miles, of which 87,410 have their outlet at Buffalo. This discharge proves to be about 275,000 cubic feet per second, or 7,000 tons, equal to the latent power every day of 200,000 tons of coal. The St. Lawrence River rises in Lake Ontario, flowing irregularly to the ocean. The entire system is a very modern river, geologically speaking, full of rapids, pools and still water. Had it existed for a long time, both rapids and lakes would have disappeared by erosion and drainage, save as an overflow prevails because of submergence.

The Niagara River is a strait, connecting Lakes Erie and Ontario. Its depth is very constant, but varies with storms. A westerly gale may crowd water from Lake Erie; while a northerly wind may push it in a contrary direction. For this reason the falls were once almost dry for several hours.

The following statement of the various physical features is needed for the discussion of the history and age of the gorge. They are compiled from the maps of the United States Lake Survey and the United States Geological Survey.

	Miles or feet.	Altitude above sea.	Descent in feet.	Width.
Lake Erie	....	573	......	1 2-5 miles.
Buffalo to head of rapids	22.50 miles.	563	10	
Rapids to head of falls	.75 mile.	517	46	1,060 feet.
American fall	....	520	165	3,010 feet.
Canadian fall	....	517	160	average 1,300 ft.
Great gorge to railroad bridge	11,750 ft. 2.25 miles.	340	17	750 feet.
Whirlpool Rapids	3.900 ft. .74 mile.	295	45	1,200 feet.
Eddy Basin	1,500 ft. .28 mile.	285	10	1,300 feet.
Whirlpool Basin	1,900 feet.	282	3	1,300 ft. to 1.25 m.
Whirlpool to edge of Escarpment at St. David's	3 miles.	......	....	1,300 feet.
Cove section	3,750 feet.	......	....	1,300–1,700 ft.
Foster's Island to Catholic College	5,754 feet.	......	....	1,100–1,300 ft.
Catholic College to mouth of gorge	8,468 feet.	......	....	1,100–1,700 ft.
Whirlpool to Lewiston	3,465 miles.	249	33	2,400 feet.
Lewiston to Lake Ontario	7 miles.	247	2	
Lake Erie to Lake Ontario	37,165 miles.	......	326	
Niagara Plateau	....	600	......	

EARLY GEOLOGICAL HISTORY.

In the study of the geological history of the vicinity of Niagara, three great periods may be designated, each characterized by peculiar conditions. First, the laying down of the crystalline foundations; second, the deposition of the Silurian and later sediments upon the Archean; third, erosion and the accumulation of earth, sands, and clays. The first witnessed the action of fire; the second indicated the presence of the ocean, and the third demanded the movement of enormous glaciers with the formation of great lakes.

The nearest locality of the Archean crystallines outcropping at the surface, is in Canada, more than a hundred miles to the north. The rocks are of the granite order—derived from the primeval crust. The southern border of this Archean coincided with a shore line from the Thousand Islands to Georgian Bay on Lake Huron, against which the sands, limestones and clays of the Lower Silurian terranes were slowly deposited in definite order. A boring 1,600 feet deep at the edge of Lake Ontario, through these lower deposits, might reach the crystalline schists, which must also extend below Niagara. A restoration of the conditions prevailing here all through Silurian time would show bands of sediment added one by one to the crystalline tract—each age indicating a growing area of land, while the shore line moved southerly. At Lewiston the red clays and sands of the Medina terrane prevail, and they constitute the visible foundation of the plateau. The sands represent an ancient sea beach which supported worms, mollusca and trilobites, besides marine plants. The waves pushed shells upwards, and as the water receded there would be left the lines made by the upper limit of the surf, and rill marks produced by the rush of the current

THE DRIVEWAY. GOAT ISLAND.

over the valves of the brachiopods. Every vestige of wave action is perfectly preserved in the solid rock. In another period limestone was produced. Evidently this was a coral growth, for their remains are abundant. Stated definitely, the following is the order of the terranes: first, the Medina group, consisting of soft red shales and sandstones below, a gray sandstone, and another series of red sandstone and shales; in all a thousand feet in thickness. Above the Medina is the Clinton group of shales and limestone, followed by the Niagara shale and limestone. At Lewiston above the water-level the Medina is 210 feet thick; the Clinton, 29; the Niagara shale, 82, and the limestone, 20. The last becomes thicker in passing southerly, reaching 65 feet, of which 55 are exposed at the falls. This variation is due to a greater erosion at the north. The shale was a calcareous mud containing organic matter, which still emits an oily smell when freshly broken.

After the deposition of the layers named, there ensued the Salina period, when large bodies of salt accumulated from the evaporation of ocean water. This rock lies to the south of the gorge, and before reaching Buffalo the Lower Helderburg limestone succeeds; so that the whole of the Upper Silurian is displayed along the Niagara River, with a thickness of about 900 feet. These rocks constitute a plateau, extending as far east as Rochester, and north to Georgian Bay; the northern edge has a steep slope, which runs parallel to Lake Ontario and then turns northwesterly and reaches the promonotory between the two sections of Lake Huron.* The strata underlying this plateau slope southerly about twelve feet to the mile. The altitude of the plain is about six hundred feet above the sea.

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*See plate 1.

The Genessee and the Niagara are the most important streams that have sawed through it. The smaller streams, like the Tonawanda, Chippewa, and the Grand of Ontario, flow along depressions in this plateau, and its general mass may be compared to a dam, causing the water from the south to accumulate as Lake Erie.

After the deposition of the Upper Silurian terranes the work of continent-building shifted to the south: thick flags, grits and shale mainly constituting the Devonian system, followed by carboniferous sediments supporting an immense vegetation over the region of the Appalachian coal fields, and eventually rising into mountains at the close of the Paleozoic. Thus originated a grand system of drainage, arising in West Virginia, southwestern Pennsylvania, eastern Ohio, and western New York, tributary to the St. Lawrence. The Monongahela and Youghiogheney, rising in West Virginia, flowed northerly down the Ohio to the great bend in Beaver County, and then continuing in the same direction in the valley of the Big Beaver River, the Conoquenessing, the Shenango, and over the present divide by Conneaut Lake into Lake Erie. The rocky floor slopes from Pittsburg northerly. The drainage of the upper Allegheny River was also to the north, the reverse of that now prevailing. A part of it joined the stream just described, flowing from Oil City up French Creek, thence into the Conneaut. Another river began to the southeast of Warren, Pa., ascended the present Conewango Creek, and at Falconer, N. Y., received the drainage of the upper Allegheny from Potter County, Pa., receiving also the outlet from Chautauqua Lake, and reached Lake Erie at Dunkirk. Of course the present streams discharging into Lake Erie from Buffalo around to Lake St. Clair flowed as at present. As the result, there was a very large river made up from these tributaries, which followed the main channel of Lake Erie, leaving it at the mouth of the Grand River of Ontario, pursuing a northerly and northeasterly course till it reached Lake Ontario at Hamilton. Plate I. is drawn to represent the drainage system of this ancient Erigan River. Like the modern Niagara, it was compelled to cut its way through the plateau. Prof. J. W. Spencer was the first to point out the existence of this great river across the Ontario peninsula, and he clearly proved its course through the Dundas Valley in a cañon much exceeding the dimensions of the modern Niagara, now covered by drift.* This system of drainage doubtless existed through all Mesozoic and Tertiary time. Coeval with the flowage of the Erigan River, was the excavation of the basin of Lake Ontario.

It was stated above that the Lower Silurian rocks, which are calcareous, occupy the region between the escarpment and the crystallines of Ontario. The ordinary subaerial agents of erosion must have been occupied with the removal of these limestones during the whole time from their deposition to the present. Because these rocks were more easily removed than the overlying sandstone, the drainage was made to move easterly from the very first. In a similar manner the whole of the Appalachian Valley from the St. Lawrence to Alabama has been excavated; eight and ten thousand feet of strata having disappeared. Perhaps it may be possible to explain the excavation of Lake Ontario below the sea level by the constant flowage of water containing the limestone in soluton. In this way rock can be excavated below the natural fall from a higher to a lower level, and thus save the necessity of a belief in a change of altitude to explain deep seated excavations in soluble materials.

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* **American Philosophical Society Proceedings, Vol. XIX. 1881.**

ADVENT OF THE ICE AGE.

Near the close of the Tertiary Age the continent rose thousands of feet, judging from the submerged fiords upon both coasts. It may have been that this elevation was great enough to allow Lake Ontario to flow to the Atlantic. The amount was sufficient to bring on intense cold, so as to cover the land with glaciers. The latest view, hardly as yet elaborated, represents the succession of three or more glacial epochs, the first culminating in a Cordilleran ice cap, with its maximum in British Columbia. Glaciers moved across the Saskatchewan plains and down the upper Missouri Valley. It is not proved that it extended as far as to the great lakes. With a change in the climate, the Cordilleran cap disappeared, followed by a temperate epoch; and then a second ice cap accumulated on the northwest shores of Hudson's Bay. Though upon a low foundation this ice grew to mountainous altitudes, known as the Kewatin mass, which moved southerly into the Mississippi Valley and southeasterly over the great lakes. As southeast courses of striæ are common in the Ontario peninsula, it is probable that this incursion brought material to fill up the Erigan Valley; and thus in the temperate period following, the drainage of that water-course accumulated to give us Lake Erie. As the discharge by the way of Grand River and the Dundas Valley had been impeded by the glacial debris, the water was compelled to seek an outlet through the Niagara depression, and hence the birth of the Niagara River. No one can tell how extensive were the previously existing excavations made by the pre-glacial Tonawanda and Chippewa Rivers. Whatever they were, the new river took possession of the valley and pushed northerly past the whirlpool and the St. David's channel to a confluence with Lake Ontario at its extreme northerly end. This early Niagara carried no less water than it does now—perhaps more—and its sources may have been confined to the Erigan Basin. These were capable of eroding the greater Dundas Valley; and why not the earlier Niagara as well? The gorge, as we lose sight of it at the whirlpool, equals in its dimensions those of any part of the chasm: while the St. David's terminus much exceeds in size the outlet at Lewiston. If the entire Erigan drainage were not availabl, the upper great lakes must have been in existence and flowed through Lake St. Clair, as at present. The third glacial epoch will be mentioned later.

Reality of the St. David's Channel.

The following considerations may aid us in the belief in the reality of the St. David's Channel: (1) The direct route is the natural course of the river, and for 1,000 feet the water still flows as in the former time. (2) The bend of the river at the whirlpool is phenomenal, nothing like it has yet been described among the numerous canyons of the Cordilleras. (3) The character of the material in the gorge is such as implies glacial transportation. At the end of the whirlpool about a hundred feet thickness of sand and clay are well exposed to view, underlying red till filling the whole gorge nearly forty feet higher than the flat surface of the limestone just at the outlet. This, till at the trestle over Bowman's Creek, holds considerably clay over a very stony mass. The creek clings to the west wall, not following the middle of the gorge, as commonly represented upon the Lake Survey maps. About one and a half miles northwesterly wells have been sunk a hundred feet in earth without reaching rock. Half a mile farther, two railroads have cut deeply through sand; and at the edge of the plateau are several cuttings and pits of gravel, certainly fifty feet deep. This modified drift may be a mile wide. It resembles an esker; and must represent the melting of a glacial tongue pushing from the main sheet up a notch in the edge of the plateau. The width of the gap in the rocky escarpment is about one and one-third miles. (4) The west wall of the canyon has been glaciated, for fully a half mile northerly from a point opposite the outlet. The smoothing and striation is upon both the Niagara and Clinton limestones, with a southeast direction, corresponding to the course of the gorge itself, but differing fully seventy degrees from that observed upon the surface of the plateau. The same course has been noted at Thorold, and is quite common near the Dundas Valley; so that it is not necessarily a local deflection produced by the crowding of the ice through the St. David's Channel; it may result from the movement that blocked the Erigan gorge, though it seems better to refer it to the later epoch. (5) The depth of the Niagara River in the whirlpool and just below, in the lower gorge, are best explained by supposing the existence of an earlier St. David's Channel. The water is 150 feet deep in the whirlpool, is very shallow at the outlet, making a shelf there, while the normal great depth is renewed below. Deep excavations are made by a cataract; shallow ones, by rapids. When the river had worn back nearly to the whirlpool, there would be only a narrow rim separating the cataract from the ponded water above. The pressure of the water above would knock the wall down laterally, and thus there would have been no pounding of the lower layers by the cataract. If the wearing action had been effected by falling water continuously around the great bend, the depth would have been uniform, whereas now there is a shallow river. Hence, it is evident that the whirlpool pit existed before the origination of the lower gorge.

Granting the existence of St. David's Channel the following events seem to have been necessitated: (1) A Niagara River, fully equal in dimensions to the present stream, flowed from the whirlpool to the edge of the escarpment near St. David's, and thence to Lake Ontario. A cataract commenced at the cliff and cut its way back the entire distance of three miles. As intimated above, we can understand that sufficient water came down the Erigan river to accomplish this result; and, therefore, it is not necessary to say that the upper great lakes contributed their share, as now, to swell the stream; yet they may have done so. (2) Frigid conditions brought on a third ice sheet [Labrador] which pressed against the edge of the bluff, broadened the mouth of the gorge, especially eroding the western wall because of the movement in a southwesterly direction, and filled the channel with till and modified drift. to the height of 300 feet. (3) The return of temperate conditions melted the ice and restored Niagara River, but it had not sufficient volume to overflow the barrier of till. Hence, it turned its direction to the northeast, following a slight depression in the plateau to the edge of the escarpment at Lewiston. After the stream had cut its way back to what remained of the original channel, the whirlpool was set in motion.

EROSION OF THE LOWER GORGE.

There must have been some erosion in pre-glacial times along the lower part of this section, as is evidenced by the tributary canyons at the Devil's Hole and Smeaton Creek. What it amounted to in the main stream, no one can tell. The top of the cliff at Lewiston is about 575 feet, and the fall 325 feet. It would not have been well defined at first, because of the greater altitude of Lake Ontario and the character of the rock. The fall being over the Niagara limestone and shale directly into the level of the lake, would present a cataract 100 feet high, and could not act energetically upon the Clinton limestone beneath. Hence this becomes an upper fall, receding more rapidly than a second one, which would make its appearance as soon as the lake disappeared. For similar reasons this would wear away only the Clinton limestone and shale of 30 feet thickness. Thus there would be two cataracts, separated by a considerable interval. There remains the Medina sandstones and shales, which would have their own cataract, and so Niagara commenced the excavation of the lower gorge by a triple division of its energy.

This view is confirmed by a study of the Falls of the Genessee, 70 miles further east, at Rochester. The lower fall there, is over the Medina terrane. One-fourth of a mile higher, is the second fall of 25 feet over the Clinton limestone. A mile and a half above is the greater fall of 110 feet over the Niagara limestone and shale, precisely as at Niagara. The strata dip to the south in a similar way, but the limestone is only 70 feet thick, as opposed to 140 feet farther west. The escarpment is less pronounced at Rochester.

Two very important conclusions follow: First, the upper falls, receding more rapidly at first and more slowly afterwards, must have reached the island at Wintergreen flat before the lower cataracts caught up with it. Second, the falls being worn out individually, the depth of the excavations must have been small. The profound depths of the upper great gorge are wholly

THE FOOTWAY. GOAT ISLAND.

wanting below the island. The width of the lower gorge is nearly as great as that above the railroad bridges, but the water is not very deep. Even if the whole volume of the present river was concerned in the erosion, the depth would be small.

Of the 330 feet exposed in the cliff at the mouth of the gorge, about 200 belong to the Medina terrane, and must have been the material over which the lower fall poured. This dips southerly, so that only 40 feet of it rise above the river at the whirlpool. While this fall receded slowly at first, its pace would be greatly quickened in passing southerly. The second fall must have receded uniformly, because the thickness of the Clinton is the same throughout. The upper limestone is twice as thick as the whirlpool as at Lewiston. So the upper fall could not recede so fast as at first, and the lower cataract gained constantly upon it.

Looking at the amount of water in the early Ontario, the Niagara must have fallen into it at a level 135 higher than it is now. This would have brought the level of the water to the top of the lower grey sandstone, or that just at the river's surface at the whirlpool. The lower fall, then, did not start so early as the others. But in a later epoch the lake receded so that its surface was over 80 feet lower than now. With the greater depth of fall the erosion of the lower rock would have proceeded more energetically. Perhaps the average recession has been the same as if there had been no variation in its rate. We do not consider in this sketch the excavation of the softer parts of the Medina terrane below Lewiston. Its presence neither accelerated nor retarded the excavation of the greater gorge.

A mile below the whirlpool there seems to have been an island in the midst of the channel analogous to Goat Island between the American and Canadian falls. Foster's flat shows a surface that was swept by the river before the excavation of the gorge. About fifteen feet below the level of the electric road at Wintergreen flat, is a rock terrace, 750 feet long, and 600 feet broad, which is believed to have been fashioned by the western part of the early Niagara; and at its northern end is a precipice over which the water fell into Foster's glen. The sloping area between the flat and the river, 2,500 feet long, and 750 feet wide, is covered by immense blocks of Niagara limestone. The explanation given by Dr. Gilbert* is essentially as follows. The river wore its way back to the lower limit of Foster's glen in a single broad cataract. Here, it was divided by a narrow strip analogous to Goat Island at the existing falls; the main channel being upon the American, instead of the Canadian side. The falls receded faster upon the eastern side; so that when the island had been passed, all the stream was captured by the American branch, and the Canadian fall ceased to exist. In this erosion the river wore out a peculiar notch pointing northeasterly to the Wintergreen platform. The island disappeared later because of the undermining of the shale and the consequent fall of the limestone. The published contours show the northeast extension of the rock below Wintergreen flat. The cataract did not excavate anything below the Clinton limestone upon this island. These and other details in the gorge are exhibited in Plate II.

HISTORY OF THE GREAT LAKES.

In continuing our study of the cañon, the next section to be described is that of the whirlpool rapids, where the gorge is very narrow. To appreciate the views entertained respecting the condition of Niagara River when this section was excavated, it will be necessary to take into account the variations in the size and drainage of the upper great lakes developed during the melting of the Labrador ice-sheet. At present these bodies of water discharge through Niagara. In the past, this has not always been the case; and whenever the drainage of any of these lakes has been diverted elsewhere, the volume of the Niagara has been just so much diminished. First, we endeavor to determine the position and succession of these lakes; secondly, to correlate these bodies of water with the making of the different sections of the gorge. Necessarily these conclusions at present must be regarded as only tentative.

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* "Niagara Falls and Their History," monograph of National Geographic Society, 1895.

It is premised that the whole of the region of the great lakes, from Ontario to Superior, was covered by the Labrador ice-sheet, moving southwesterly and receding northeasterly. The greatest movement would have been in the valleys, as that was in the region of least resistance. The valleys thus occupied were those of Lake Superior at Duluth and south of Keweenaw point; Lake Michigan at Green Bay and Chicago; Lake Huron near Saginaw, Lake St. Clair and Georgian Bay. The ice thawed at the ends of these glacial lobes; and as they receded considerabe water accumulated above the level of the several outlets, or what are now watersheds. Hence, quite early in the recession there were simultaneous lakes at Duluth, the water draining into the St. Croix River 468 feet above Lake Superior; at Chicago, only 58 feet higher than Lake Michigan, flowing into the Des Plaines River, and at Fort Wayne, Indiana, 225 feet higher than Lake Erie, emptying into the Wabash River. Each of these small lakes increased in size as fast as the ice to the northeast melted; until finally, without mentioning details, the waters of Lakes Superior, Michigan, Huron, and Erie were combined into one body. discharging at Chicago, because this was the lowest point in the whole shore line, the altitude being about 600 feet. This has received the name of Warren Lake.

Later in the history the outlet shifted to the east, and while the St. Lawrence was still blockaded the discharge was through the Mohawk River into the Hudson and thence to the sea. This has been called Algonquin Lake, continuous from Superior, across Huron and Erie to Ontario. When the water had fallen to 144 feet above Erie, a strait connected the two lower lakes. A beach and spit, formed at this time at Lundy's Lane, near Niagara, has been described by Spencer, who notes it also at Fort Hill, Ontario, and Ebenezer, New York. No epoch of prolonged rest seems to have been reached in the further process of shallowing, till Erie was ponded separately from Ontario by the Johnson Ridge (so named by Spencer), the highest divide crossing the Niagara gorge near Inspiration Point. This would represent the beginning of the present Niagara, discharging the waters of Erie into the Ontario basin, with an outlet still through the Mohawk. For a time the water rested at a level 300 feet below the Lundy beach, and 220 feet above the present Ontario, and has been named Lake Iroquois. It received the outflow from Lake Algonquin through the Georgian Bay of Huron, into Lake Simcoe and Trent River. The St. Clair outlet was probably closed while the Trent River connected Huron with Iroquois.

The ice front receded next so as to change the outlet of the upper lakes from the Trent to the Ottawa River, via Lake Nipissing, originating the sprawling Nipissing great lake, entirely disconnected with Lake Erie, which now had an independent existence with a Niagara much reduced in size. This epoch is regarded by F. B. Taylor as coeval with the highest extension of the sea to Lake Ontario in the Champlain time. Before this, the ice barrier to the east had disappeared and the St. Lawrence begun its independent existence, relieving the Mohawk.

The study of the deserted strands of these several lakes has led to a belief in their deformation. A breach encircling a lake, should certainly be formed at the same level; when carefully followed from point to point, it has been discovered to be unequally elevated above the water. The rise of the land has been invariably to the northeast; and the decline to the southwest. When the land to the northeast rises, the water will move to the southwest, and the old beach be elevated at one end and depressed at the other. This result may be illustrated by tipping a bowl containing water. The liquid will rise towards the edge that has been depressed and fall away from the raised part. If a lake had its outlet on the southwest side, the canting opposite may have been great enough to cause it to discharge in the opposite direction. Such a deformation may have been the cause of the shifting of the outlet of Lake Warren from Chicago to the Mohawk; if the canting should be in the opposite direction, the place of discharge might also be changed. Dr. Gilbert presents considerations to show that the northeast uplifting of the rims of the lake barriers is still in progress. Should this continue a few thousand years from now henceforth, Niagara would cease to run, the wharves of Buffalo would need extension, and the outlet for all the great lakes, except Ontario, would be at Chicago. Lake Erie is now only nine feet lower than Lake Michigan; so that but little change of level would be required to effect this change.

A brief statement of the altitudes of the Iroquois beach around Lake Ontario may render the preceding paragraph better understood. This beach is now much lower at the west end. Prof. Spencer finds it to stand at 362 feet above the sea at Hamilton, Ontario, and to rise to 632 feet at Trenton, Ontario, at the east end of Ontario. Dr. Gilbert finds this beach to be 370 feet at St. David's, Ontario, and traces it to 657 feet at Adams, New York. The rise of this beach near the west end of Ontario is 1.60 foot per mile. Near Oneida Lake the uplift is 3.5 feet per mile, and near Watertown, New York, it is 5 feet per mile. The total rise from Hamilton to Trenton is 270 feet; from Hamilton to Adams, 295 feet. Other beaches have been found beneath the Iroquois, which pass under the lake in going west. Thus near Watertown, there is one 200 feet lower; at Oswego, one 185 feet lower than the Iroquois beach. Continuing this lower beach westward, it should be found 78 feet below the surface of Ontario, off the mouth of the Niagara River, which stream would have extended four miles further north, cutting a channel through shales. The existence of the conditions requisite for the formation of this beach affords us the evidence of the former greater fall of Niagara over the Lewiston escarpment, mentioned above.

It is interesting to note the most western limit of the sea in the Ontario basin. Ramsay mentions the occurrence of marine shells at Kingston, Ontario; and the cetacean cited by J. W. Dawson at Smith's Falls cave from an altitude of 440 feet. Taylor states that the top of this deposit is about thirty feet higher, which would be 223 feet above Ontario. The beach, 200 feet below the Iroquois level at Watertown, must be 210 feet above Ontario. Is it possible that this is of marine origin?

The near approach of the levels to each other proves the former connection of the ocean with Lake Ontario in the Champlain period. It extended likewise above Pembroke, in the valley of the Ottawa. This marine shore-line is traced down the St. Lawrence to the gulf, culminating near the Saguenay, at about 800 feet above the sea; so that the differential elevation indicated by the Lake Iroquois beds was continued through most of Lower Canada.

From the statements now made of the history of the great lakes, there seems to have been two former possible outlets for the waters above St. Clair—by the Trent river and Lake Nipissing; and it has been suggested by Dr. Gilbert that, when the discharge was by the former route, the Niagara river cut its way through the shoals at Wintergreen flat; and that when the water flowed through the Nipissing channel, the gorge of the whirlpool rapids was excavated. Both those routes are shown distinctly upon the map, Plate I. It is not easy to show just what part of the lower gorge was excavated when the upper lakes discharged through the Trent outlet. At the present writing, it may be best to say that, because of the limited time during which this discharge was effective, no marked effect was produced.

It is different with the Nipissing outlet. Mr. Taylor has shown that this discharge must have operated for a very long period. The Nipissing beach is recognized upon all the upper lakes, being the best defined of any of the ancient strands. At the outlet at North Bay it is 120 feet above Lake Huron; 45 feet in Mackinaw Straits; 50 feet above Lake Superior at Sault Ste. Marie; and passes beneath the lake level 40 feet at Port Huron, 100 feet at Chicago, and 25 feet at Duluth. Fully eight-ninths of the water passed to the Ottawa River, leaving only one-ninth of the present volume for the Niagara. Consequently the gorge made by the Erie-Niagara must have been comparatively small. Its width at the top is 750 feet, and the depth of the river estimated at 35 feet. The descent is 45 feet, and the length three-fourths of a mile.

There is quite a contrast between these and the rapids above the cataract, which descend the same amount and have a similar length. The action is deliberate in the one, and impetuous in the other. The shallowness may result because of the want of erosive power in the smaller volume of water falling over the cliff, or may be due in part to the superior hardness of the rock at the base of the falls, as suggested by Professor James Hall.

Some authors, following Pohlman, believe this part of the gorge was made by a smaller stream in pre-glacial times, perhaps in connection with the St. David's Channel, and before the modern Niagara came into being. This seems inadmissible, because the St. David's Channel evidently required a river of large volume for its excavation, greater than the Erie-Niagara, and the whirlpool rapids' gorge had a later origin. These facts also enforce the conclusion that it is not likely that in any case a small gorge would have been enlarged to the full width by the later greater volume of water. Were this true, this narrow section should show evidences of increasing enlargement during the latest episode of excavation. All agree that the river which excavated this section was of comparatively small size, and, consequently, that the duration of this episode must have been correspondingly great.

There is a shoal ledge between the whirlpool and Eddy basin not unlike the one between the whirlpool and cove, which was accounted for by supposing the presence of the water removed a rim of rock rapidly, without the aid of the cataract. Mr. Taylor suggests a species of weathering for its presence here. It is presumed that the St. David's Niagara eroded the gorge back to this ledge, when the work suddenly stopped. If the cliff were exposed to the elements for a time, the falling of talus blocks would ensue, with some weathering. Or the ice known to have moved through the buried gorge may have impinged against this ledge and fractured it. It must be remembered that, according to our views, this ledge was exposed for a very long time—while the whole of the gorge between the whirlpool and Lewiston was being excavated; so that the cliff could hardly fail to have been operated upon in some way. When the cataract commenced above the whirlpool, it would be occupied first with removing débris, and not in channeling out the bottom. These suggestions may show why that ledge remained shoal.

THE UPPER SECTION.

Between the falls and the railroad bridges, a distance of two and one-fourth miles, the interpretation of the history is easy. The gorge is uniformly of great width and depth, 1,300 feet in width and with the ordinary depth of 160 feet for the river. At the very cataract the bottom of the river is 100 feet lower than the level of Lake Ontario. The water moves slowly, falling about seven feet to the mile. The rocks vary but little in this section. All agree that the conditions determining the formation of this gorge are practically the same with those now prevailing; and, consequently, the only change in the scenery has been the position of the cataract. Having the same volume as now, the levels of all the upper lakes have not varied appreciably. Without doubt, during this episode, the falls have been viewed by the aborigines of our continent as they carried their canoes and cargoes from lake to lake.

The increase in the volume of water is supposed to have been occasioned by the rising of the land at North Bay; damming the water and compelling it to wear its channel through Lake St. Clair to Lake Erie. When the rush began, it bared many acres of rock on both sides of the river, leaving various denuded tracts, as the flat two miles in length, south of the steel arch bridge, on the Canadian side, and a very narrow strip on the American side, reaching as low as to the whirlpool, give evidence. These flats are like the bed of Niagara above the rapids, if the water were removed and vegetation had gained a footing. Because of the presence of these old river beds where the Johnson ridge crosses the gorge, it seems to us that it furnishes no obstacle to the free passage of the water. This ridge is an anticlinal swelling in the strata, but had been broken down by early erosion, so that really no greater mass of limestone has been excavated here than elsewhere in this section.

Goat Island rose higher than the water on either side, and, therefore, dividing the stream into unequal portions. Its former extension northerly may be indicated by the promontory directly opposite the north end of the American fall, utilized as a pier for the landing of the Maid of the Mist, for there is a rescission in the cliff just behind. It would seem that the former northerly extent of the island crowded the Canadian fall so that it was compelled to excavate a place for itself, and cut into the wall back of the promontory.

The occurrence of fluviatile shells in various places along the banks illustrates another phase in this history: the presence of water, sometimes thirty feet above the present level. The highest locality observed is at the Bowen place, three miles above the falls. Next, they are well shown in the recent excavations for the new wheel-pit of the Cataract Construction Company. The opening shows two feet of clay and sand at the surface, overlying a thicker sandy mass containing *Cyclas*, *Goniobasis*, *Unio* and *Planorbis* in considerable abundance. At the base of the earthy material is a mass of till ten feet thick, resting upon the glaciated surface of the Niagara limestone. The locality upon Goat Island has been studied by Lyell and Hall. In a gravel pit now being excavated these same shells occur plentifully; some of the *Unios* and *Cyclas* still having their valves closed. This deposit is fully twenty-five feet thick, mostly of course gravel, readily correlated with corresponding beds in the villages upon both sides of the river. At Clifton sixteen species have been found, adding to the above the genera *Physa*, *Limnæa*, *Paludina*, *Amnicola*, *Margaritana* and *Pisidium*. Other localities are just below the railroad bridges on the west side, and on both sides of the whirlpool. Their surface altitudes vary from 566 to 575 feet above the sea. Professor Hall says that the pebbles upon Goat Island have been transported northerly, as they contain fragments of the Black Rock limestone at Buffalo. He thinks the action was fluviatile, the first condition having been that of a quiet lake, followed by quite a strong current. Hence, the correlation is with the lake covering this region after the deposition of the Lundy beach.

RECESSION OF THE CATARACT.

Everyone has heard how the cataract recedes and the gorge elongates. The water pours over a cliff of hard limestone, from 140 to 170 feet deep, and pounds upon the soft rocks beneath.

As these give way, the higher, harder strata project like cornices, and when they have assumed considerable prominence, being unsupported they fall down. As seen from Horseshoe Fall, erosion is more effective in the center of the current. The stream rushes more and more furiously into the middle, and tends to abstract some water from the sides—perhaps leaving large surfaces of rock bare. The undermining of the cliffs cause these "table-rocks" to fall, eventually, and thus the width of the gorge is kept essentially uniform; and in the long run, the breadth keeps pace with the extreme points or erosion.

Only a few years' interval is required for noting these changes. Within the 30 years of my own observation, the middle of the Horseshoe Fall has become more pointed, and the amount of water at the margins runs more feebly, or else has developed bare surfaces. In illustration of the increase of the width of the gorge, I may quote from a telegram sent to the Press 25 years since, which may be duplicated every 25 years:

> GREAT FALL OF ROCK AT NIAGARA FALLS.—Buffalo, September 5th.—Several hundred tons of rock, which projected from the side of the bank in Prospect Park, beneath the platform which overlooks the Maid of the Midst landing, and about midway from the top of the bank, fell this morning. No damage was done. The immense mass of débris fell with a crash which was heard in the village. It does not in any way affect the top of the bank in this vicinity.

The piles of talus upon both flanks of the gorge throughout its seven miles of extent, testify to the wide extent and constancy of this movement. The fragments at the base of the cataract will be broken quite rapidly, as nothing can resist the force of the fall. The depth of the water here is greater below the level of the stream than the height of the rock above. The limestone is from 60 to 80 feet thick; the shale, 82; the Clinton limestone, 30 feet. Beneath the water level there may be 200 feet of the Medina terrane.

By comparing the best views of the falls taken at different dates, it is very easy to note the fact of recession. Precision has been given to the rate by careful measurements, with the most delicate instruments, of the positions of every part of the cataracts at stated intervals. It is usual to compare the positions determined trigonometrically by Prof. Hall in 1842, and in 1890 by Engineer A. S. Kibbe. During this period of 48 years, about 220 feet in length of the limestone has been removed, or about 4½ feet each year. This means that the gorge is lengthened by this amount each year. Although the uppermost part of the fall is narrow, the gorge will broaden as fast as the apex recedes, as explained above; and therefore it is reasonable to use the rate of recession of the fall as equivalent to the average of elongation of the gorge. Here and there the gorge may widen or contract, according to variations in the volume of the water, its velocity, the width of the channels, the thickness of the limestones and other rocks, their comparative hardness, etc. It is not our purpose to present allowances for these varied conditions, as the approximate estimate derived from the rate of recession will indicate how the calculations should be made.

ESTIMATES OF AGE IN YEARS.

Let us assume the present rate of recession to be four feet annually. This is less than what has been observed, but some think that the time for the wearing action must have been greater, and the omission of the half foot may be nearer the true figure. There is a greater thickness of limestone at the Johnson ridge than elsewhere, in the first section of the gorge, from the falls to near the railroad bridges, and possibly more time would be required for its erosion. But it seems as if this excess of thickness was removed in pre-glacial times, because the flat produced by the ancient bed of the river, before the erosion of the rock had been effected, slopes uniformly, without regard to the presence of the ridge. Hence this excess of rock has not materially affected the rate of erosion here. The total length of this first section of the gorge is 11,750 feet. This measurement was made in 1875, and the gorge must now be over 100 feet longer, making the entire length 11,850 feet. Divide this by four, the number of feet the cataract recedes annually, and the quotient is 2,962; *i. e.* the beginning of the great cataract dates back to 1062 B. C., 300 years before the time of Romulus, or to the reign of King David at Jerusalem.

The next section is that of the whirlpool rapids, 3,900 feet. If the water of Niagara came from Lake Erie alone, under existing conditions, its volume would have been three-fourteenths of the present flow. This is less than the volume of the water pouring over the American fall, which recedes 0.64 of a foot annually. This stream may be conceived to wear away the rock at the rate of six inches annually. If so, it would have required 7,800 years for the formation of the gorge of the whirlpool rapids.

The Eddy basin seems to have been worn by the normal Niagara. With the same rate as has been given for the first section, only 375 years would be required to erode this distance of 1,500 feet. The whirlpool belongs to the St. David's epoch, and will be considered in another connection.

The Cove section, or the part from the whirlpool to the narrows at Foster's Island, is 3,750 feet long. No one imagines the rate of the recession for this section to be different from that first named, as the width of the gorge and the depth of the water are the same. This would have required 937 years for its excavation.

Professor Spencer has calculated the age of the lower section of the gorge from Lewiston to Foster's Island to be 17,200 years, upon the assumption that the conditions would be those of the American falls. But measurements of the breadth below the Cove section give an average of width of the top of the gorge, fully equal to that of the upper gorge as far as to the Catholic College, 5,754 feet, while the other part, 8,418 feet, may for convenience be comparable to the American falls. Calculations upon these bases give 1,438 years for the upper part, and 5,406 years for the lower, a total of 6,844 years.

The section from the beginning of the whirlpool to the edge of the escarpment, near St. David's, is about three miles in length. Its erosion was effected before the last ice-epoch, according to our interpretation, and some might say pre-glacial. It would appear that the volume of the water passing through was fully equal to that of the present epoch, and may have been derived from the same sources. At the rate of recession adopted for the greater gorge, the time must have been at least 3,960 years. This does not account for the greater width of the mouth of the gorge, which may have been either waterworn, or eroded by the ice-sheet.

The sum of the figures given above amounts to 18,918 years for the present gorge, to which might be added the figure for the St. David's channel—making in all 22,878 years.

Professor Spencer's estimate of the age, including the whirlpool, but not the St. David's channel, sums up 31,000 years, to which he adds a thousand years for the duration of the river before the advent of the falls. Sir Charles Lyell gave the figure of 36,000; Professor Warren Upham, 10,000, and F. B. Taylor would estimate it to lie between 36,000 and 50,000.

Other estimates of the age of parts of the gorge are based upon the alleged time required for the warping of the basins. Involving the correctness of suggested correlation, they cannot have the value of the direct estimates, but are useful by way of comparison. That presented by Dr. Gilbert of the age of the Nipissing outlet well illustrates the method employed. First of all came the determination of the fact of tilting, and its rate. Three pairs of stations were selected, one between Milwaukee, Wis., and Port Austin, Mich., connecting Lakes Michigan and Huron; another between Cleveland, Ohio, and Port Colborne on Lake Erie, and the third between Charlotte and Sacket Harbor, N. Y., on Lake Ontario. Bench marks were established, and accurate observations recorded of the height attained by the water each day for three months, in the summer of 1896. Care was taken to eliminate from the observed figures the levels affected by tides, seiches, storms, and the seasons. At some of the stations, observations had been made for many years, which were used for comparison. The general conclusion reached, was that there is a rise in the land from southwest to northeast, at the rate of 0.42 feet per century. Assuming this rate to have been uniform and secular, Dr. Gilbert estimates that the time when the drainage was shifted from North Bay to Port Huron must have been about 10,000 years. This he would make to correspond with the date of the position of the cataract at the head of the whirlpool rapids. Professor Spencer's figure, for the same date, is 7,800 as deduced from differential elevations. For the total length of time since the Algonquin Lake existed, which corresponds to the age of Niagara, Professor Spencer obtains the figure of 28,000 years.

PRINCIPAL EVENTS IN THE NIAGARA DISTRICT.

It may be useful to summarize the various episodes in the geological history of the region of Niagara, as now delineated. In the not distant future, geologists may be able to give them value in centuries or years.

1. Laying down of the crystalline Archean floor, upon which the Cambrian and Lower Silurian terranes were deposited in order, before the dry land reached as far south as Lake Ontario.

2. Deposition of the Upper Silurian members of the series: (a) Medina clays and sands resting upon the raised Lower Silurian land, and extending from Lake Ontario to some distance south of the falls. (b) Clinton shale and limestone. (c) Niagara shale and limestone, both formed below the ocean's surface; coral reefs extensive. (d) Onondaga, or Salina, salt group.

3. Land gradually rising and attaining a considerable altitude at the close of the Paleozoic era. Subaerial denudation continued through later periods, during which time the basin of Ontario takes shape.

4. Age of Erigan River. Drainage of country from the Appalachian coal fields northerly, discharging through the Dundas Valley into Lake Ontario.

5. First ice age, that of the Cordilleras. Not certain that its influence was felt in the Niagara region.

6. Second ice age, the Keewatin. Blocking up of Erigan River. Ice moves southerly; its melting gives birth to Lake Erie.

7. Temperate epoch. Wearing of the gorge through the St. David's Channel, including the whirlpool, 3,960 years.

8. Accumulation of ice upon the Labrador highlands and its movement southwesterly, as far south as to the Ohio River, filling the St. David's Channel. Terminal moraines left as it recedes; one near Buffalo, and the next from Lockport across to Toronto.

9. Warren Lake, discharging at Chicago, occupying parts of Lakes Michigan, Huron and Erie.

10. Algonquin Lake was composed of Lakes Superior, Michigan and Huron, discharging into the Ontario basin through Lake Erie, or by way of Balsam Lake and Trent River, and thence through the Mohawk into Hudson River. Erie was tributary. The waters sank to the level of Lundy Lake, after which the Niagara River began its flow; accumulation of deposits with fluviatile shells.

11. Iroquois Lake, as expanse of Lake Ontario succeeded, discharging through the Mohawk. Beginning of the erosion of the lower gorge. River divided by the island below Wintergreen flat. Time of erosion 6,844 years.

12. Erosion of the Cove section requiring a river as large as the present Niagara. Breaking of the barrier at outlet of whirlpool. Time, 937 years.

13. Period of erosion of the gorge of the whirlpool rapids, when the water of Lake Erie alone was concerned. Outlet of upper lakes perhaps through Lake Nipissing. Time, 7,800 years.

14. Restoration of full volume of Niagara River. Upper great gorge excavated from the railroad bridges to the existing cataract. Time, 2,962 years.

Time since the water fell over the Niagara escarpment, 18,918 years. Between this epoch and the shifting of the

Labrador ice-sheet from the Niagara River valley there intervened Lakes Warren and Algonquin (events 9 and 10), probably not of long duration. Nothing about Niagara gives us any clue to the duration of the Labrador ice-sheet. The time of the wearing of the whirlpool basin, 475 years, is not included in the estimate of the age of the general gorge.

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